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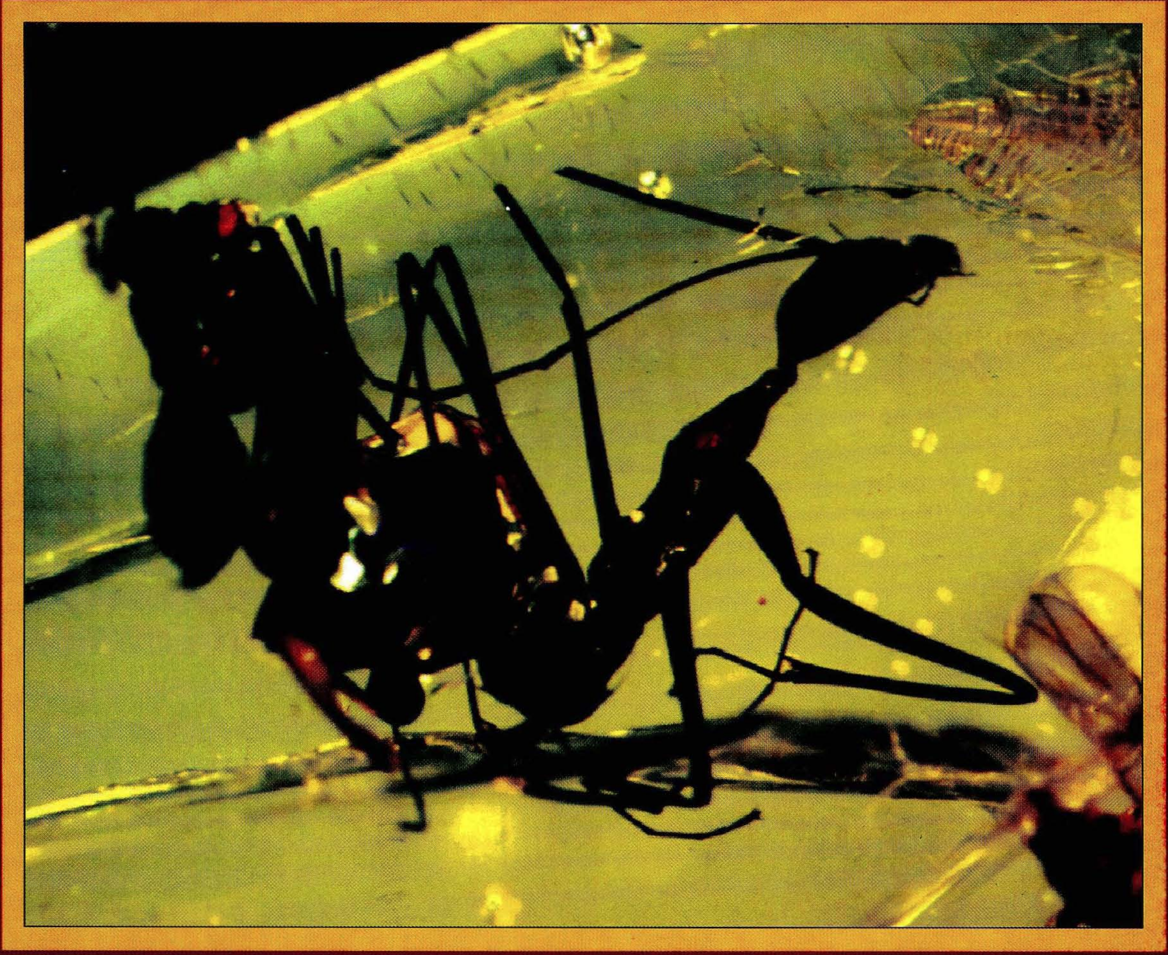

Was The Flood Initiated by Catastrophic Plate Tectonics?

The Influence of the Copernican Revolution on Biblical Interpretation

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The *Leptomyrmex* ant fossilized in Dominican amber. An identical ant lives today in Australia. Such fossils are known as 'living fossils' and demonstrate the absence of evolution within this species. *Photograph by Joachim Scheven.*

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Editorial

RETHINKING our cherished beliefs is never a comfortable experience. But it is something that, at one time or another, we all have to do. Only God and the truths revealed about Him in Scripture are immutable, whereas our own opinions are fallible and in need of constant revision and re-evaluation.

Anyone who has watched *The Genesis Solution* will have seen Ken Ham make this point very forcefully. We are used to thinking that evolutionary ideas need to be re-evaluated in the light of Scripture, but what about our own ideas? As we seek to live Christ-like lives, we should always be concerned that our thinking accords with what the Bible tells us about the world, and that we maintain the highest possible standards of intellectual honesty.

Unfortunately, we do not always live up to our high calling. In our attempts to popularize, it is all too easy to be over-simplistic and to overstate our case. I am all too aware that I have fallen into this trap myself. It is possible to put across complex ideas in a way that can be grasped by the layman, but it is an art that we desperately need to master. Those of us on the editorial team of *Origins* know that we have much to learn in this regard. Also, we should not be frightened to admit that some scientific evidence is problematic to us. As Dr. Siegfried Scherer pointed out in his closing address to the Third International Conference on Creationism in 1994, sometimes the data appear to support evolution. It is not shameful to acknowledge that we don't have all the answers.

In addition to the risks of over-simplifying and overstating, there is the danger of blatant error. Too many of the arguments appealed to in contemporary creationist literature are simply wrong! Such a controversial claim, I know, demands justification, so here are a few examples. Even today it is not uncommon to find references in creationist publications to the discovery of man tracks alongside dinosaur tracks in the Paluxy River. But this argument no longer holds water—the so-called human tracks have been shown to be nothing of the kind, and groups like the Institute for Creation Research stopped appealing to the Paluxy tracks long ago (Morris, 1986). Another argument (it used to be a favourite of mine) was that the thickness of lunar dust supported a young age for the moon. This argument was shown to be flawed by creationists Andrew Snelling and Dave Rush in an in-depth review article (Snelling and Rush, 1993) but it is still repeated today as though nothing had changed. Another argument commonly encountered in creationist literature is that large-scale overthrusts do not exist, and are just evolutionary devices to explain away out-of-order fossils. This is simply not true. There is clear physical evidence, independent of fossils, that overthrusting can and has taken place in the geological past, as an increasing number of creationist geologists are recognizing. Our question and answer section in this issue of *Origins* tackles another controversial claim—that a decomposed carcass trawled off the coast of New Zealand in 1977 was that of a modern-day plesiosaur. Many of these erroneous arguments have taken hold in creationist publications, and are repeated *ad nauseam*, with little effort made to check that they are sound. Allowing these arguments to persist in our literature only provides our opponents with ready ammunition to use against us.

A current area of debate and controversy within creationism is about where the Flood ends in the geological record. In America and Australia, most creationists think that the Flood laid down all the sediments from the Cambrian through to the Cretaceous, and possibly the majority of the post-Cretaceous sediments also (Holt, 1996). But many of us in Europe maintain that this position is indefensible and believe that the Flood ended much earlier in the geological record than this, probably sometime during the Carboniferous (Garner, 1996a; Garner, 1996b; Garton, 1996; Robinson, 1996; Scheven, 1996; Tyler, 1996). This is no peripheral issue as it affects so many of our scientific interpretations, and it urgently needs to be resolved. The latest issue of the Australian *Creation Ex Nihilo Technical Journal* is devoted to this debate, and we are pleased in this edition of *Origins* to have a critique by Steven Robinson of the Flood model proposed by 'The Gang of Six' at the 1994 Pittsburgh conference.

I realize that some fellow creationists will think that I have been overly negative in this editorial, but I hope that my thoughts won't be regarded in that way. Anyone who has ever taken part in a debate will know that it is not a good idea to tie a strong argument to a weak one. If we are successful in excising our bad arguments and honing our good ones, then creationism will emerge the better for it. We have some formidable arguments on our side; we do not need to rely on others that are more dubious. Too many Christians, even fellow evangelicals, have been put off creationism because of our failure in the past to adhere to high standards of academic rigour. Many have taken refuge in 'complementarity' or 'theistic evolution'. Only by putting our own house in order can we hope to win these people back. It is true that a huge amount of creationist research and thinking remains to be done. On the other hand, I suspect that a great deal would be achieved simply by acting on what we already know.

Paul Garner

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The Impact of the Copernican Revolution on Biblical Interpretation

David J. Tyler

BIBLICAL passages which refer to the Earth not being moved and the sun moving have helped to crystallise thinking on the interpretation of Scripture. For many centuries, these verses were interpreted in the context of the dominant philosophy of the time, which was geocentrist. A Polish scholar known as Copernicus published, on his deathbed, a radical challenge to the consensus—arguing a case for heliocentricity.

This was the time of the Reformation, when the principles of biblical interpretation were being discussed, and the Copernican controversy provided a major test case for both the Roman Catholic and the Reformed community to show how they would handle such a 'hot potato'. It is a matter of history that Copernicanism spread far more rapidly among the Protestants than among the Catholics. We need to ask 'why?'. This article seeks to identify and discuss some of the issues surrounding these historical events.

The subject has contemporary relevance as the revival of creationism has been accompanied by a small but significant revival of geocentrism. For the new geocentrists, the two trends are very closely connected as both areas of belief are perceived to derive directly from Scripture. However, most of the major creationist organisations have distanced themselves from geocentrism—but not always convincingly. Many people still seem to believe that the Bible teaches geocentrism and critics such as Lerner (1994) assert that:

> '... the Bible is at least as explicit, and certainly more repetitive, in asserting that the universe is centred on the Earth'.

Clearly, it is vital for Christians to know both what the Bible does teach and how to handle contrary claims. To assist these goals, historical studies (of which this is one) have a role to play.

Background to the Scientific Revolution

The contribution of Greek philosophers to the rise of modern science is a much-discussed, and sometimes contentious, subject. In the disciplines of logic, mathematics and astronomy, their strengths are undeniable. Controversy concerns the role these intellectual skills had in promoting modern science. One consequence of their impressive achievements was that a synthesis of Greek thinking, notably Aristotelian philosophy, was incorporated into Catholic theology by Thomas Aquinas in the 12th century AD. It swiftly became the orthodoxy taught in universities across Europe—a situation which was to continue for many centuries. Geocentricity was an integral part of Aristotelianism.

The people who actually participated in the scientific revolution often felt that they were moving away from the principles of knowledge developed by Aristotle and his followers: in particular, the concept of logical necessity. The Greeks had a tremendous confidence in the power of reason and logic. They believed that their philosophical schemes were sufficiently robust for them to reach, by processes of deduction, an understanding of the true nature of the physical world. They developed mathematical techniques to support their deductive approach to intellectual activity. Their style of mathematics started with axioms and proceeded by a series of proofs to conclusions. As an instrument in the hands of the philosophers, mathematics was highly prized. It was known as the 'handmaiden' of philosophy. It is worth noting that the term 'pure mathematics' is still used today in this Greek sense.

The prominence of the concept of logical necessity and the associated tendency to deductive styles of reasoning meant that the Greeks never developed the experimental method as a way of testing hypotheses and revising understanding of the physical world. Thus, as long as their methodology for knowledge acquisition was retained, their ideas could not be successfully challenged. Any real advance in knowledge had to be revolutionary.

Copernicus and the Biblical Texts

Copernicus was a church administrator who belonged to a group of humanists in the pre-Reformation church which was heavily influenced by the theologian Erasmus. This group stood for unity, tolerance and reformation in the church. However, Copernicus devoted much time and effort to matters of astronomy. He came to his radical views of heliocentricity, not because he was a revolutionary at heart, nor because he had adopted the experimental method, but because he wanted to find a way of improving the calendar, particularly the dates of Easter and of Christmas. The Ptolemaic mathematical system for describing the movements of the heavenly bodies had become ever more complex in order to make it conform to observation. Copernicus shared the disquiet expressed by neo-Platonists in Italy that the simple grandeur of the original mathematical system (*i.e.* everything moves in circular paths) had been lost (Kaiser, 1991, p.100). According to his disciple Rheticus, he felt that the Ptolemaic advocates:

> '... fashioned their theories and devices for correcting the motion of the heavenly bodies with too little regard for the rule which reminds us that the order and motions of the heavenly spheres agree in an absolute system' (Rosen, 1971, p.138).

Copernicus claimed that his mathematical model of the movements of the astronomical bodies gave a better fit to data than the established Ptolemaic model—and he believed his model was closer to reality. Many others agreed with him. Some were prepared to use his mathematical model without committing themselves to the validity of the physical model. There were no significant objections on the grounds that his mathematics failed to improve the predictions of astronomical phenomena. The concept of exposing theoretical models of the world to empirical tests was grossly under-developed by the Greeks. Copernicus quietly adopted a methodological principle that was destined to change the world. This was a fundamental departure from Aristotelianism and the principle of logical necessity—earning Copernicus the right to be called a pioneer of the scientific revolution.

Without going into details, it is worth noting that Copernicus still faced substantial problems:

1. The central premise of heliocentricity was still not proven by the analysis. He could only claim that the resultant picture of the natural world was much simpler and more satisfying.
2. The strength of Copernicus's arguments rested in mathematics—a discipline widely regarded as lower in the 'order' than the discipline being revolutionised.
3. Very few people were competent to evaluate Copernicus's thesis.
4. Nearly everyone who was deemed to be competent held to the existing orthodoxy of geocentricity, which was also the teaching of the Church and the universities.
5. There were biblical texts which were considered to teach geocentricity.
6. Common sense and experience suggested a stationary Earth and moving heavenly bodies.

These difficulties help to explain why Copernicanism was not an instant success. People were very slow to align themselves with these new ideas. The hard line approach of the Roman Catholic Church (evidenced in the Counter-Reformation) meant that many Catholics were wary of radical ideas: despite the fact that Copernicus had been a canon (an administrator) in the pre-Reformation Church and that he had dedicated his book to the Pope.

In this article, the main concern is with the fifth of the problems facing Copernicus: the biblical texts which appear to teach geocentricity. Advocates of geocentricity claimed that there were biblical passages which taught *(a)* that the Earth is in a state of rest and *(b)* that the Sun moves. These are the passages which concern us here, and we shall see that the main response to these ideas pointed out that the Bible uses the 'language of appearance'. Some of the advocates of heliocentricity maintained that the Bible teaches *(c)* that the Sun is in a state of rest and *(d)* that the Earth moves. If the language of appearance argument is on the right lines, *(c)* and *(d)* have no place in biblical exegesis and are of historic interest only.

Examples of texts used to prove that the Earth is at rest are: Psalm 93:1 'The world is firmly established; it cannot be moved', and Ecclesiastes 1:4 'Generations come and generations go, but the Earth remains for ever'. In both cases, the nature of the 'movement' and the 'remaining' was considered to be spatial. Other texts which were suggested to belong to this category are Psalm 102:25; 104:5; 119:90; Isaiah 42:5; 44:24; 48:13 and Zechariah 12:1.

Examples of texts used to prove that the Sun is in motion around the Earth are: Ecclesiastes 1:5 'The Sun rises and the Sun sets, and hurries back to where it rises', and Psalm 104:19 'The Sun knows when to go down'. Again, the 'rising', 'setting' and 'going down' were considered to have a spatial meaning. Other texts suggested to be in this category are Genesis 19:23; Joshua 10:12; Psalm 19:5; 136:6; Isaiah 38:8 and Habbakuk 3:11.

The traditional views were summarised thus by the Catholic philosopher Lodovico delle Colombe:

> 'All theologians without a single exception say that when Scripture can be understood according to the literal sense, it must never be interpreted in any other way' (cited by Westman, 1986, p.99).

These theologians saw no reason to doubt the literal sense; their own common sense view told them that the Earth did not move and that the traditions of the Church were soundly based.

The Principle of Accommodation

The Copernicans followed one of two strategies. One option was to avoid conflict by playing down the physical reality of heliocentrism. What did it matter—as long as Copernican mathematics delivered good and useful results? This strategy was a compromise, but it did enjoy a time of dominance. It was inserted as an introductory comment in Copernicus's book *de Revolutionibus* by Osiander. It was also a key thought in the Wittenberg Interpretation, championed by the reformer Melanchthon, discussed by Russell (1991).

Copernicus himself considered that his theory was physically true. Comments below relate only to some 16th century Copernicans who advocated the language of appearance argument. This is expressed in a more general way by what has become known as the 'principle of accommodation', namely, *that God has chosen to use words in Scripture which are an accommodation to the non-technical perspectives of the readers.*

Copernicus's zealous disciple Rheticus wrote about those Scriptures which appear to assist geocentrism. Rheticus was a Christian man in the Lutheran tradition, with a high view of the inspiration of the Bible.

> '... it may often be noticed in everyday speech and in writings as, when following the judgment of our senses, while we sail from the harbour, we say that the land and the towns recede from us, and when navigating we say that the mountains and lands rise up out of the sea, and that the sun and stars sink into it, and in our speech we do not distinguish the truth from the appearances.
>
> When, however, we think as [persons] who seek the truth about things, we distinguish in our minds between appearance and reality. As the saying goes: we will judge as the few, but speak as the many. Thus when right reason concludes that the sun is immobile, even though our eyes lead us to think it moves, we do not abandon the accepted way of speaking. We say that the sun rises and sets, establishes the day and the year by its motion, even though we hold this to be true only in appearance, as our reason concludes to its immobility. In fact, it is the same going north, when we say that the pole [star] rises, because so it seems to us. But reason knows well that it stays fixed, and only seems to grow higher as we see it, because of our moving towards it.
>
> But it is too well-known to need further proof, that Holy Scripture uses common and received forms and figures of speech. Whence it is clear that, however much we insist on the many descriptions of the sun's movement adduced from Scripture, these are to be understood as referring to its apparent motion, without in any way going beyond the bounds set by St. Augustine, nor introducing anything from which something inconvenient might follow. Therefore the texts of Scripture concerning the Sun's movement, which seem to argue against us, will not turn out to be at variance with the best verified results of the recent restoration of astronomy.' (Translation by Hooykaas, 1984.)

Giordano Bruno, a Dominican scholar, held the same views on the language of appearance, but presented them in a much more aggressive way. With reference to Ecclesiastes 1:5, he wrote:

> 'So if the Sage, instead of saying, 'The sun riseth and goeth down, turneth toward the south and boweth to the north wind,' had said: 'The earth turns round to the east, leaving behind the sun and sets, bows to the two tropics, that of Cancer to the south and Capricorn to the north wind,' his listeners would have stopped to think: 'What does he say that the earth moves? What kind of fables are these?' In the end, they would have accounted him a madman, and he really would have been a madman'. (Cited by Westman, 1984, pp.91–2.)

Johannes Kepler, also a Lutheran, was fully committed to heliocentricity. His views on the biblical texts are found in his book *Astronomia Nova* (1609). The accommodation principle is prominent, as is also his devotion to Scripture. The following paragraph comments on Psalm 104:5.

> 'But some men think Psalm 104 to be wholly concerned with physics, since it is wholly concerned with physical matters. And there God is said to have *laid the foundations of the earth so that it should not be moved*, and that stability will remain from age to age. Nevertheless the Psalmist is a very long way from speculation about physical causes. He rests utterly in the greatness of God who made all these things and is unfolding a hymn to God the Creator, a hymn in which he runs in order through the whole world as it appears to our eyes.' (Goodman, 1973, p.23).

Calvin's influence must be regarded as highly significant among the Reformed churches. He did not address the issue of geocentricity, although he uses Aristotelian phraseology sufficiently often for us to infer he had, in some matters, absorbed the culture of the day. In the 'Argument' of his Commentary on Genesis (1554), he wrote:

> 'We are not ignorant, that the circuit of the heavens is finite, and that the Earth, like a little globe, is placed in the centre.'

Nevertheless, Calvin did allow the principle of accommodation to apply in the resolution of various problems of interpretation. Commenting on Genesis 1:16, the greater and lesser lights, he tackled the objection that other objects (such as Saturn) might be brighter in absolute terms than the moon:

> 'Moses wrote in a popular style things which, without instruction, all ordinary persons, endued with common sense, are able to understand; but astronomers investigate with great labour whatever the sagacity of the human mind can comprehend. Nevertheless, this study is not to be reprobated, nor this science to be condemned, because some frantic persons are wont boldly to reject whatever is unknown to them. For astronomy is not only pleasant, but also very useful to be known: it cannot be denied that this art unfolds the admirable wisdom of God ...
>
> Nor did Moses truly wish to withdraw us from this pursuit in omitting such things as are peculiar to the art; but because he was ordained a teacher as well of the unlearned and rude as of the learned, he could not otherwise fulfil his office than by descending to this grosser method of instruction. Had he spoken of things

> generally unknown, the uneducated might have pleaded in excuse that such subjects were beyond their capacity. Lastly, since the Spirit of God here opens a common school for all, it is not surprising that he should chiefly choose those subjects which would be intelligible to all … Moses, therefore, rather adapts his discourse to common usage … There is therefore no reason why janglers should deride the unskilfulness of Moses in making the moon the second luminary; for he does not call us up into heaven, he only proposes things which lie before our eyes' (Calvin, 1554).

Acceptance of Copernicanism was a slow process, as has already been noted. In addition, it should be remembered that Europe was in political and religious turmoil for several generations subsequent to the publication of *de Revolutionibus*. However, Protestant scholars were far more receptive than their Catholic counterparts. Hooykaas (1972) provides ample evidence to justify his assertion: 'Undoubtedly, Calvin's accommodation theory had a considerable influence with Copernican astronomers in Protestant countries' (p.122). The Wittenberg School saw changes too: from using Copernican mathematics for its predictive power to acceptance of the model as accurately representing reality.

> 'At first [the Wittenberg astronomers] were only pragmatically interested in the possibility of improved calculations, but gradually they came to accept the underlying hypothesis that the sun was really stationary at the centre of the planetary system' (Kaiser, 1991, p.140).

This article is not intended to provide a review of all the reactions to Copernicus. Many others have addressed this theme. Nor is it to imply that all the debate was at a high level—many of the protagonists showed very little evidence of allegiance to the Scriptures (Galileo, for example, had a real mixture of responses, and he is not the best place to start when looking for an understanding of these issues). Rather, it is to point out that the 'language of appearance' was identified at the outset of the controversy as a positive, uncompromising approach to understanding the Scriptures.

Discussion

In view of these historical developments, it is important that Christians today have clear ideas about what the 'language of appearance' means and what it does not mean. Even more important, we need to assess whether the principle of accommodation is a faithful guide in the interpretation of Scripture.

This article is written with the conviction that the Bible is a-scientific or non-scientific in terms of understanding technical matters. Nevertheless, I consider that the Bible provides the principles necessary for science to develop, namely, the concept of natural law, the predictability of God's providential government of his creation, the rejection of 'logical necessity' as a way of discovering the nature of the world, the sense of wonder and awe in discovery of God's handiwork, and the sense of duty and stewardship in undertaking scientific work.

The Bible transcends discussions of underlying science. It deals with *descriptions* of the natural world—what things look like. It provides us with a *theistic perspective on the physical world*—providing a conceptual framework which is a foundation for scientific work. It is concerned with real *events* in the world—there is a strong sense of history. It deals with *mankind*—his relation to God and to his fellows. It deals with *God*—His mighty acts in history, His revelation of Himself in word and in Christ. At the same time, this revelation comes from the infinite God to finite man. Though God has created us to understand spiritual truth, He has constrained us by space and time. Understanding can therefore only be partial. So, for example, when God speaks to us about the afterlife, we can understand, but we know we are out of our depth. The reality of our finiteness necessitates revelation being adapted to our condition. No discussion of the principle of accommodation can be acceptable which does not address this point.

The Copernican Revolution brought a very important contribution which is not often clarified in the literature. It helped to trigger change in the attitude of Christians towards biblical interpretation. True, people like Calvin were developing the hermeneutic principle of accommodation before Copernicanism became an issue. But it certainly helped to see this clear example of what the teaching means. In the context in which the principle was first developed, accommodation is not liberalism, nor does it sacrifice a high view of biblical inspiration. It reminds us that the Bible is a book for all generations—with principles to guide our studies of God's world, but not with divinely-revealed answers to our technical questions. This is the spirit of the quotations emerging from the Reformers and from some of the early scientists.

The fallacy of 'literalism' is that each age brings its own 'intellectual baggage' to the reading of God's Word. Literalism has no consistent approach to hermeneutics, but picks what it wants and accommodates the rest. This is not a satisfying way of handling God's Word! At its best, 'literalism' can only point to veiled references to modern ideas.

Applications

1. *A principle of interpretation*

The principle of accommodation, if it is accepted as a basic principle of biblical interpretation, needs to be explored in greater detail than it has been to date. It has been described as a principle of literary relativity. Examples of the way the principle can be applied are as follows.

(a) Aspects related to words used in Scripture. Language itself is an accommodation. God is using human language to communicate with us. The first chapter of the Bible gives us important instruction on the types of words God uses. In this chapter, God names various things He makes. He gives the names 'day' and 'night'; and in verse 8 He names the 'sky'. This is a word describing appearance rather than physical nature. The word is phenomenological, not

technical. 'Atmosphere' would be a possible technical word—but a technical word here would have all sorts of ramifications. For example, birds fly in, not across, the atmosphere (compare with verse 20). Technical words require a precision of usage which God could easily have employed—but He chose not to do so. Instead, He chose words which are adapted to human limitations and which are based on perception. Such words introduce no errors and do not deceive—and they are meaningful throughout human history.

(b) Aspects related to the appearance of things. The geocentricity/heliocentricity controversy is the most notable example of accommodation relating to appearances. But others will be found. For example: do rabbits 'chew the cud'? (Leviticus 11:6). This has created problems for those who know that rabbits appear to chew the cud but are not actually ruminants! We know today that rabbits are chewing partly digested food—but it is not cud from a rumen. (Even if the translation 'rabbit' is questionable (Melnick, 1994), the point made about the appearance of things still stands). Another example concerns the classification of bats: both Leviticus 11:19 and Deuteronomy 14:18 refer to bats at the end of a long list of undoubted birds. This raises the question: why associate bats with birds—when they are taxonomically so different? If we look for technical precision here, we are liable to struggle. The reason the bat is in the list is that it shares with birds the ability to fly. Both these examples draw attention to shared behavioural features which transcend biological differences.

(c) Aspects related to purpose and meaning. It is not rare to find passages of Scripture referring to God's purpose apparently being frustrated, and this must be considered in the light of clear teaching that nothing can frustrate God's will. Similar tensions may emerge when we read of God 'repenting' of something He did—when we know that God's omniscience is such that He never needs to change His mind about anything. Such examples are best approached with the principle of accommodation to hand.

(d) Aspects related to perspicuity. The point was well made by Calvin that the Scriptures are for the unlearned as well as the learned. Discourse is adapted to common usage. If the principle is valid, our reading of Scripture must do it justice! Too often, there have been zealous attempts to find scientifically advanced concepts in the Scriptures—which lack any consideration of accommodation. This point has a direct bearing on the 'partial accommodationists' discussed below.

2. *Accommodation and evolution*

Many Christians have argued that accommodation requires an acceptance of the theory of evolution as an explanation of the origin of living things. 'The battle was fought on geocentrism—let us learn the lessons of history'. But have the lessons been learned? Is the geocentrism/heliocentrism controversy equivalent to the special creation/evolution controversy? This is a subject which deserves detailed treatment—and it is intended to address this topic in a subsequent article. However, the key points of difference can be summarised:

1. The accommodation associated with Copernicanism relates to the appearance of things, which does not apply in the case of Darwinism.
2. The Copernican accommodation has no bearing on issues of purpose, meaning or design.
3. The Copernican revolution does not touch on historical aspects of biblical revelation, whereas Darwinism requires a radical review of the history of origins.
4. Accommodation in the context of the Copernican revolution is not an accommodation to 'primitive' cosmological views. Rather, the Copernican Revolution freed people's minds from scholastic philosophy. By contrast, the Darwinian Revolution had the practical effect of enslaving people's minds to naturalism.

3. *Contemporary issues related to 'non-accommodationists'*

The principle of accommodation is rejected outright by some. This is best illustrated by reference to the advocates of geocentricity. These people consider that accommodation is an attack on the veracity of God. Thus Bouw (1992) writes, in the context of the sun 'standing still' in the day of Joshua:

> 'Thus when one claims that Joshua 10:13 is *phenomenological*, one effectively claims that God is not presenting the situation as it *actually* is but only presents it as it *appears to be.* If the appearance is not the same as actual fact, then in the final analysis God is not relaying accurate information about the situation. For the sake of 'convenience' God wrote an untruth. God presented the appearance of the situation as the truth rather than presenting the truth as the truth: this is what one means when one says that the Bible speaks phenomenologically. Phenomenological or anthropocentric: either the sun stood still or the earth stood still; either God inerrantly inspired the wording or He did not; either the Bible is trustworthy or it is not. There is no middle ground. There is no room for compromise ... Good though it may sound on the surface, accommodation still maintains that God goes along with the accepted story even though he really does not believe it' (page 75).

Bouw's summary of the issues makes the concept entirely negative and destructive. Historically, however, accommodation was not an attempt to twist God's words, and it was used by people who felt that the principle helps in rightly understanding the Word of God. This is not a controversy about inerrancy—the concern is with hermeneutics.

It is necessary to respond to Bouw's claim that accommodation makes God go along with the accepted story even though He really does not believe it. It is worth returning to a comment from Rheticus quoted earlier: 'We distinguish in our minds between appearance and reality'. In our scientific culture, we have grown accustomed to the idea that appearance and reality are two different things. We treat the appearance as something superficial and say that it is necessary to get beneath the surface and find out what's really going on! If someone then refers to the Bible using the language of appearance, we tend to think that the motive is to justify erroneous or primitive ideas in the Bible. The problem is that our cultural norms are inhibiting understanding. It is important to come back again to the thought that the culture of the Bible is a-scientific or non-scientific. Within this culture, the appearance is not to be regarded as something which conceals reality. On the contrary, the appearance is the reality. So, for example, it is entirely legitimate for such a person to describe the sun as rising in the east and setting in the west—this is reality!

4. *Contemporary issues related to 'partial accommodationists'*

Partial accommodationists accept the principle of accommodation when addressing the issue of geocentricity, and may also use it in other contexts, but at the same time find various 'literal' readings of Scripture remarkably suggestive of contemporary scientific concepts (Westman, 1984, p.91). The partial accommodationists like to think that because God is the author of the words, evidences of inspiration are seen in the glimpses given of advanced understanding.

A recent example of this approach is to be found in Humphreys's 'biblically-based' cosmology (1994). He has constructed an exciting scenario of origins using guidelines drawn from the Bible including: the Earth is at/near the centre of the universe, and the 'deep' of Genesis 1:2 comprised all the matter of the universe. Without wishing to be negative about Humphreys's reconstruction of the events during creation week, the two guidelines noted in the previous sentence do appear to me to be inconsistent with the principle of accommodation. The Earth is central both from our perspective and according to God's purpose, but this does not mean that it is spatially central in the created universe. Humphreys's new interpretation of the 'deep' requires a level of conceptual ability (involving relativistic physics) which is more appropriate to the late 20th century than to the time of Moses.

Other examples are not difficult to find. One concerns the discovery of the oceanic currents by Maury in the last century (Meyer, 1982). Maury was stimulated by a phrase in Psalm 8: the 'paths of the seas', and concluded that there were natural paths through the seas, even as there were natural paths through mountain passes. As he developed his thinking, he contributed much to the discipline of oceanography. It is a pleasing incident in the history of navigation—but this does not justify the biblical interpretation. The movements of sea animals, rather than the movements of water, might be expected to identify the paths of the sea referred to in the Psalm.

Perhaps the most pressing concept needing clarification concerns the created 'kinds'. In a helpful review of the historical aspects of 'kinds' and 'species', Landgren (1993) has shown that attempts to read a technical meaning into the Hebrew *min* have created considerable confusion in the past. Jones (1972a, 1972b) has argued convincingly that the scriptural meaning most closely corresponds to today's 'family' level of classification. The important question is: do we expect the Bible to give us a technical statement about the created 'kinds'? Jones (1972a) argues that '*min* is a strict classificatory term' and (1972b) that '*min* is a precise technical term'. If the principle of accommodation is valid, a different answer might be expected. The Scripture is using the language of appearance expressing what we perceive routinely; we see many different types of living things (all the groups which, in general, we call 'families'). Scripture declares that God is the Creator of these groups. Creationists have often been challenged to define the 'kind'—but we should respond by explaining that the word is non-scientific in meaning. The technical details must be determined by observation, experiment and analysis.

5. *Accommodation and 'modernist' approaches to the Bible*

Some have made the mental leap that the 'language of appearance' is equivalent to 'primitive' and even 'erroneous'. It should be noted that none of the early advocates of the principle of accommodation made this link. Such an association of ideas is unwarranted; non-technical language is not to be equated with misinformation, but with universality and accessibility. There is no justification for using the principle of accommodation to argue that the Bible contains falsehoods. We recognise that the words of Scripture are set in a human context and the culture is not uniform throughout the Bible—and sometimes we are not sure what is contextual and what is for today. However, this is to be addressed by spiritual minds using the tools of biblical hermeneutics—not by adopting the stance of unbelief evidenced by modernists and liberals.

Accommodation can be treated as a dangerous concept—because of its misuse by those who do not show a submissive spirit to the Word of God. Hasel (1994) expresses something of this concern when he writes:

> 'Scripture, if it is to maintain its own integrity, can hardly be interpreted in such a way as to be accommodated time and again to any kind of interpretation derived from science, sociology, history, etc. Scripture, based on its own nature and authority, has its own integrity of meaning and its inherent truth claims'. (p.10)

It may be that the word 'accommodation' is not the best way to express this principle of interpretation as it can so easily be abused by compromise. It is possible that Hooykaas's suggestion is a way forward; that it is useful to distinguish between a 'world picture' and a 'world view' (1972). In the introduction to his book, he suggests that the Greeks had a very well worked out world picture—which proved to be wrong. The Hebrew Bible, by contrast, has no such world picture, but it does have a world view which has helped the development of science. However, it seems to me that even with this terminology, the opportunities for compromise are substantial. The phrase 'language of appearance' has not been significantly misused, so it is to be preferred wherever possible. However, for the more general principle, I will live with the word 'accommodation' until better terminology is found. The retention is primarily because of its constructive original use in biblical interpretation.

Concluding Comments

This article has considered the impact of the Copernican Revolution on biblical interpretation. The early Copernicans suggested that the Biblical texts are rightly understood when it is read, not as a source of knowledge about the way creation works, but when they are understood as describing the appearance of things. The 'language of appearance' argument was of great importance in the history of biblical interpretation. It was articulated independently by Calvin (who remained a geocentrist) who also broadened the concept. This became known as the 'principle of accommodation'. The subsequent history of these ideas reveals a picture of misunderstandings and abuse which have brought the principle into disrepute. This article attempts to clarify the implications of the original concepts and to discuss several issues of contemporary relevance.

In my view, the 'language of appearance' argument and the 'principle of accommodation' are positive, helpful and valid. However, this is a historical study, intended to stimulate thought. The basis for saying that these concepts are biblical deserves a separate treatment.

As a consequence of the abuse, I have suggested that an alternative term for the 'principle of accommodation' would be desirable. However, to get things in perspective, it seems to me that there are far more urgent matters to address than this. There was an alternative defence of heliocentricity which I consider to be the main entry point for erroneous interpretations. I am referring to 'the two-book approach' to knowledge. In my opinion, this approach has done great harm in promoting compartmentalisation of knowledge and making it appear that scientists can proceed with their work without reference to revealed truth. Those who imbibe this approach appear to have opened themselves to absorbing the spirit of their age. This topic is the theme of a subsequent article.

Acknowledgement

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ERRATUM

In *Origins* 20, page 19, second column, third full paragraph, the first word on line 6 should be 'subduction' not 'subjection'. Our apologies to the author and readers that we did not spot the error!

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Was The Flood Initiated by Catastrophic Plate Tectonics?

Steven J. Robinson

AT the Third International Conference on Creationism, Austin *et al.* (1994) proposed 'a global Flood model of earth history' whose leading idea was that the Flood began with slabs of ocean floor breaking loose and subducting along the margins of the pre-Flood continents.

Baumgardner has done much theoretical work to show that under certain conditions subduction of oceanic lithosphere could occur extremely rapidly. All the authors are scientists of high standing in the creationist community, and their paper deserves serious consideration. It is here summarised[1] and briefly critiqued with a view to identifying some key areas which need to be debated in working towards a viable Flood model. Since it is itself in the nature of a summary, the interested reader is strongly recommended to read the paper in its entirety. Study of the alternative theory proposed by the present author (1996a) is also recommended.

Abstract of the model

The term 'plate tectonics' refers to the process—apparently still going on today—whereby new ocean floor is created by the upwelling of magma from the earth's mantle along mid-oceanic ridges. There it cools, solidifies and spreads outwards, causing the oceanic plates at certain continental margins to plunge ('subduct') under the continents and melt into the mantle from which they originated. Because of the mantle's viscosity, it is believed that spreading rates greater than the few centimetres per year observed today would not now be possible (Baumgardner, 1986). However, sudden deformation of silicates under high temperatures would greatly reduce viscosity (Baumgardner, 1994), permitting rates of subduction much faster than those currently observed. Viscosity would also be reduced by higher mantle temperatures.

According to Genesis, the Flood began with the eruption of the springs of the great deep and the simultaneous onset of prolonged torrential rain. These events are referred to as the eruption of superheated gases from the centres of seafloor spreading, as molten material released its gaseous volatiles and vaporised the ocean water above it. In the upper atmosphere the ejected water vapour cooled and condensed into rain, which continued to fall for up to 150 days. By this point all the pre-Flood oceanic floor had been replaced by less dense, less subductible rock and plate motion all but ceased.

The rapid emplacement of hot, buoyant mantle material at the spreading centres raised the level of the ocean floor and displaced water onto the continents. Great quantities of sediments which had previously lain on the floor were transported on the moving plates in conveyor-belt fashion towards the land. At the continental margins the subducting ocean floor upwarped and the terrestrial crust downwarped, facilitating the placement of sediment onto the land, from whence earthquake-induced sea waves redistributed sediment towards the interiors. Accordingly sedimentary units tend to be thick, uniform, of unknown provenance, and regional, inter-regional or even continental in extent.

As it cooled, the new ocean crust became denser and subsided, and the waters which had covered the land drained into the deepening basins. The Flood came to an end. After the Flood—in the authors' view, from the end of the Cretaceous—oscillating rebound effects (isostatic adjustment) controlled sedimentation. Local to regional catastrophes with intense earthquake and volcanic activity were common, and terrestrial sedimentation was dominantly basinal. As the earth cooled, floral and faunal changes tracked the changing zones of climate, until eventually polar ice caps formed.

One of the principal problems which the authors seek to address—and it is also a problem for old-earth geologists—is the source of the sediments on the continental basements. The authors believe that before the Flood there were significant thicknesses of all types of sediment on the earth. The two main reasons for this belief are: (1) Archæan (probably pre-Flood) and Proterozoic sediments contain substantial quantities of all types of sediment, and (2) it may not be possible to derive all Flood sediments (certainly from the Palæozoic and Mesozoic) from igneous and/or metamorphic precursors by physical and chemical processes in the course of one year. In particular, substantial quantities of very fine detrital carbonates existed on the ocean floors, as inferred from the fact that not enough bicarbonate could have been dissolved in the pre-Flood ocean and/or could have derived from outgassing during the Flood to have produced the Palæozoic and Mesozoic carbonates.

Discussion

There is good reason to believe that the present distribution of continents and oceans is the product of

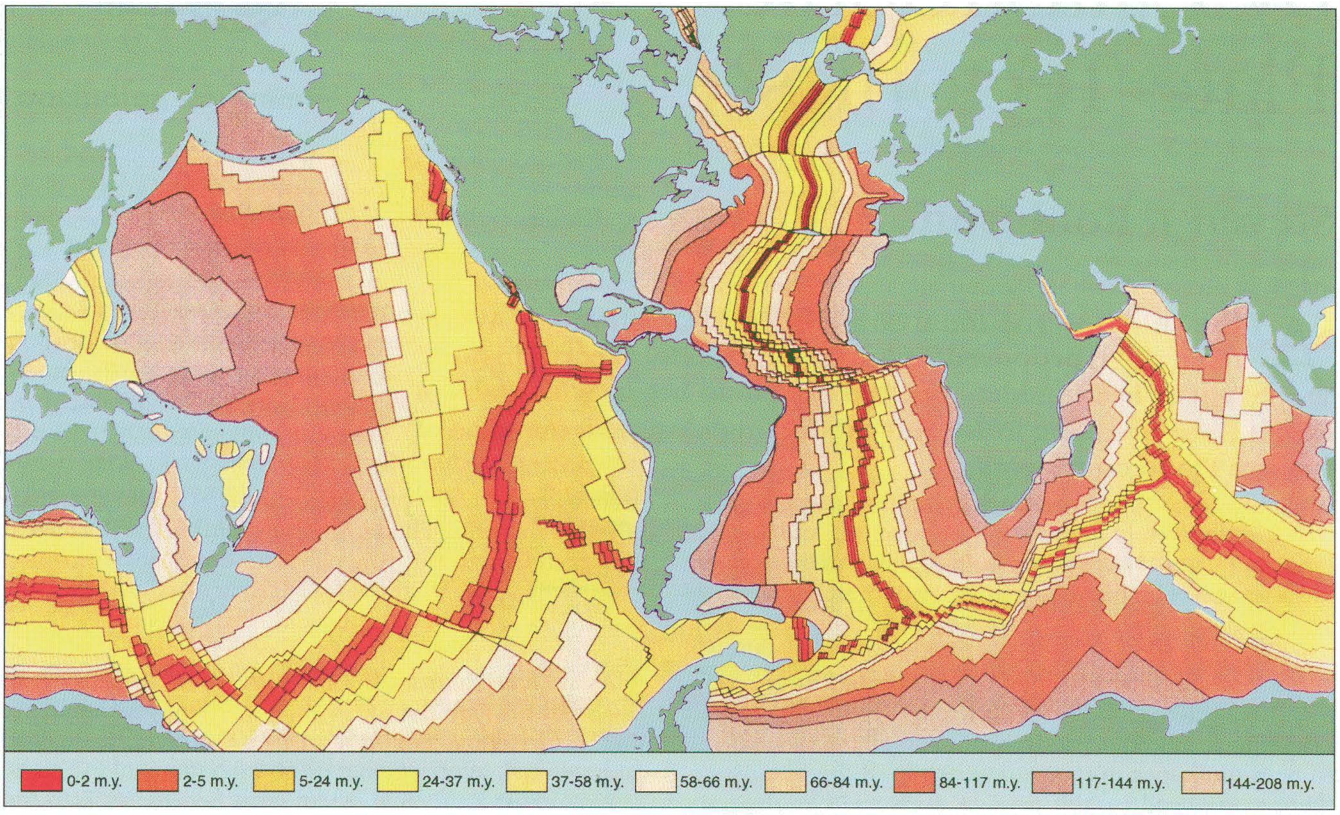

Figure 1: Relative ages of oceanic crust according to the radiometric timescale. The youngest rocks (dated by radiometry, fossils and palæomagnetism) occur along the oceanic ridges, with the crust becoming progressively older as one approaches the continents. As well as confirming the theory that the present ocean floors formed from the middle outwards, the pattern is striking confirmation of relative dating methods, which when applied to continental rocks produce vertical sequences. Note the asymmetry of the Pacific Ocean, where the northern ridge has been almost entirely subducted under the westward-moving North American Plate, and that, in accord with movements measured today, spreading rates must have been considerably faster in the Pacific than in the Atlantic. Finally, since the Atlantic is not subducting but is an extension of the continental plates on either side of it, it is clear that the Atlantic is not older than the ocean floor nearest the continents, i.e. Jurassic. By contrast, the plates of the Pacific are subducting under the surrounding continents, so that the Pacific Ocean may be older than the oldest extant floor. (After Larson et al.)

plate tectonics which began in the Jurassic, that is, well into the Mesozoic.

Although evidence for large-scale plate tectonics during the Palæozoic also exists, it is somewhat less clear, partly (it might be argued) because of the erasing effects of plate tectonics in the Mesozoic. The evidence includes Precambrian and Early Palæozoic rifting (splitting apart the cratons of Europe and North America, for example); Precambrian and Early Palæozoic ophiolites, thought to be pieces of ocean floor which were obducted onto the continents; Palæozoic orogenies, attributed to the collision of continental plates; and palæomagnetic orientations, suggesting that the geographical distribution of the continents was continually changing during the Palæozoic. In orthodox geology the most recent theory is that in the Late Precambrian North America was joined to Australia–Antarctica on its west and to South America on its east, but by Permian times Australia–Antarctica was joined to the eastern side of Africa (Dalziel *et al.*, 1994).

Since reconstructions of the earth's pre-Permian geography are still in a state of some flux and are based, of necessity, upon purely continental evidence, it would be unwise to build much on them when developing a Flood model. In this respect the most obvious contrast is that, in the Palæozoic, the continents reunited, possibly with the same configuration (Pangæa) as that with which they began, whereas there is no evidence that the present continents will reunite. The putative movements of the continents in the Palæozoic are unlike the mostly unidirectional movements of post-Triassic plate tectonics. Moreover, the opening and closing of great rifts in the earth's crust could produce ophiolites and mountain-building without plate tectonics being necessarily involved. Ophiolites are found in Arizona, for example, far below the level at which Austin and Wise (1994) identify the onset of the Flood (Dann, 1991); conversely, ophiolites are not cited by those authors at the level where they do identify the onset of the Flood. In short, acceptance of plate tectonics in the Mesozoic and Cenozoic does not entail acceptance of large-scale plate tectonics in the Palæozoic. (On the other hand, it remains a possibility.)

In their Flood model Austin *et al.* make no such distinction between the Palæozoic and the Mesozoic. Although they are not explicit on the point, they appear to be suggesting that the ocean floor around the pre-Flood supercontinent (which Baumgardner takes to be approximately equal to Pangæa of the Permo-Triassic) was being subducted continuously from the Palæozoic onwards. On the other hand, it must be recognised that the Mesozoic rifting of Pangæa itself, whereby the Americas separated from Africa and Europe to form the Atlantic Ocean, was a development distinct from the plate tectonics already going on at the margins of Pangæa.

If this understanding of the model is correct, it puts the authors in an uncomfortable position. Palæozoic plate tectonics is intended to explain the rise of global sea-levels in the Palæozoic, a rise which they would identify—one presumes, for surprisingly there is no reference to sea-level curves—with the Genesis Flood. The basic idea is that the emplacement of hot, buoyant magma at the spreading centres raised the level of the ocean floor and displaced water onto the continents; conversely, sea-levels fell as the magma cooled—a nexus that is well recognised in orthodox geology (Hays and Pitman, 1973). However, if the global sea-level curves of Hallam (1984) and Haq *et al.* (1988) are understood to be consistent with global flooding in the Early Palæozoic, would it not be reasonable to interpret the evidence which indicates a fall of sea-level in the Late Palæozoic as evidence that flooding—and hence large-scale plate tectonics—in most places was coming to an end? (Compare Figure 3.) If the Flood continued to the end of the Mesozoic, the authors need to account for the geological evidence which indicates that it did *not* end then. In particular, they need to show how it is possible to postulate the cessation of catastrophic plate tectonics 'very possibly' 150 days into the Flood year (by which time the fountains of the deep were stopped and the windows of heaven were closed), when the geological evidence shows that plate tectonics was going on throughout the Mesozoic and into the Cenozoic.

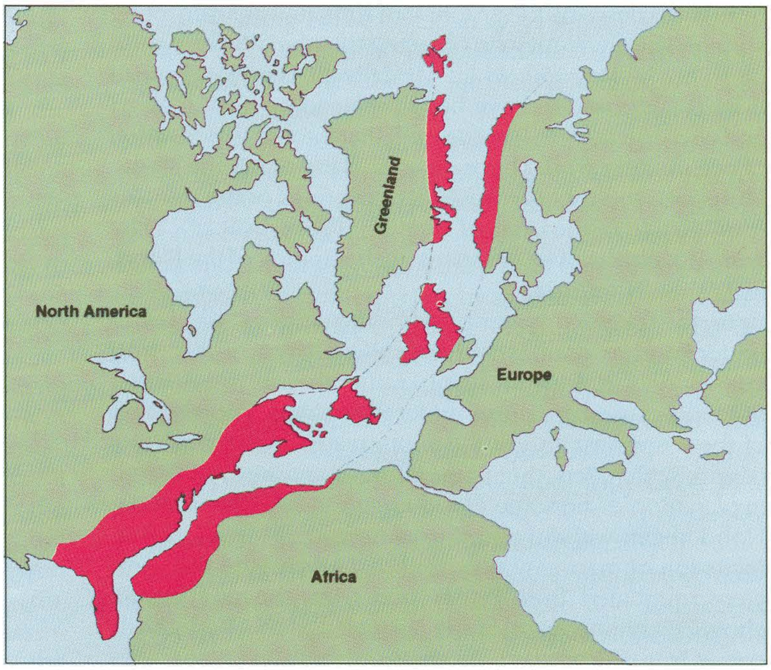

Figure 2: The mountains which stretch from the Appalachians through the British Isles to Greenland and Norway are of a similar geological age and are believed to have formed in the Middle to Late Palæozoic, when the associated landmasses collided with one another during the formation of the Pangæa supercontinent. (After Tarbuck & Lutgens)

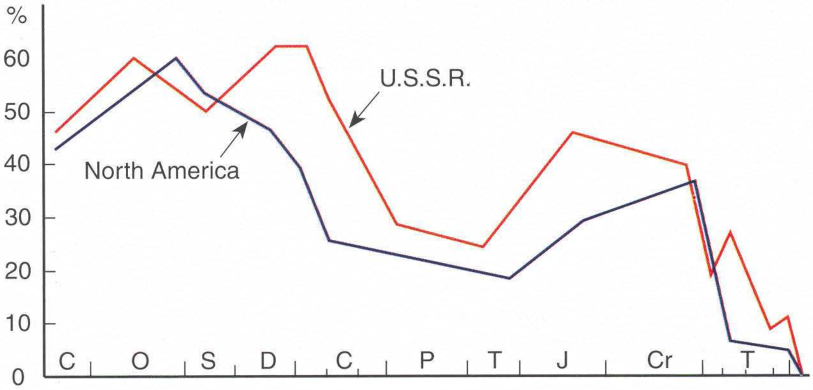

Figure 3: Percentage area of North America and the former U.S.S.R. covered by sea from the Cambrian to the present day. Palæozoic values are thought to underestimate the extent of marine cover and there may have been a still higher degree of inundation in the Precambrian. Sea-levels do not reach their lowest level until geologically recent time. (After Hallam, 1977)

Similarly, under the heading 'volcanic activity', the authors mention as support for their model the extensive continental flood basalts of South Africa, India and Siberia. However, these formations date from no earlier than Late Permian, and as Garner has pointed out (1996), they possess the characteristics of subaerial deposition (unlike, for example, the basalts of ocean floors). Since they lie on the continental margins, where marine inundation must be supposed to have occurred very early in the Flood year, it is far from clear how the continental basalts provide support for the model proposed, with its assumption that the Flood/post-Flood boundary should be placed as late as the end of the Mesozoic.

Equally difficult is the interpretation that the springs of the great deep in Genesis 7:11 denote geyser activity caused by mantle material erupting on Day 1 of the Flood in mid-ocean. Firstly, there is the hermeneutic problem of supposing that the Genesis record speaks of events which Noah can neither have inferred nor have witnessed, particularly as the passage does, in fact, appear to be an eyewitness account. Secondly, it is not easy to see how the effects of catastrophic rifting and upwelling of magma could have manifested themselves as one 'linear geyser' (surely an odd combination of words) or even as discrete geysers. One wonders whether the authors have fully appreciated the explosive effects of mixing water and lava on this scale (Colgate & Sigurgeirsson, 1973). Would one have thought to describe the eruption of Krakatoa as an erupting spring? Thirdly, it may be objected that the oceans would be so hot by Day 150, when 'virtually all' pre-Flood ocean floor is supposed to have been replaced by fresh magma and geyser activity to have ceased, that intense vaporisation of ocean water would have continued even after the Flood. Moreover, the Bible represents the springs of the deep as forming part of the original creation (Proverbs 8:28). They were not effects of eruptions at the beginning of the Flood; they already existed.

In the present writer's view, the springs are better understood as springs watering the surface of the earth (Hasel, 1974; Robinson, 1996b) rather than as pre-existing or Flood-caused apertures under the oceans. The eruption of these springs, and of the subterrestrial reservoirs ('the deep') which fed them, therefore suggests a different explanation of how the Flood began. It suggests that the Flood began with an eruption of terrestrial waters, not an incursion of marine waters, and that all parts of the earth were inundated from below and from the rain waters above simultaneously. Some support for this hypothesis comes from the work of Marshak and Paulsen (1996), who remark upon the evidence that in Proterozoic to Eocambrian times (1,500–700 Myr ago) the North American craton was ruptured by numerous rift faults. These rifts developed as a result of the craton being stretched (extensional tectonism), not—as the model predicts (Snelling, 1995, p.18)—through lateral compression of the craton. The invasion of the sea from the Eocambrian onwards followed that rifting (and inundation).

As Molen has pointed out (1994), the model is also confronted with a considerable heat problem. Apart from the friction which would have built up between the oceanic plates and underlying mantle, immense heat must have been released from the magma which entirely resurfaced the earth's ocean basins within 5 months. Most forms of oceanic life could not have survived the high water temperatures with which they would have come into contact as the currents produced by these events swept landward. By contrast, the fossil record of the Mesozoic shows the regeneration of marine life, after catastrophic depletion which reached its worst in the Late Permian. Likewise, oxygen isotope data (for what they are worth) suggest that, although high-latitude temperatures—inexplicably from an old-age point of view—were much warmer in the mid-Cretaceous than they are today, tropical temperatures were no warmer than today (Figure 4). In the mid Cretaceous, post-Palæozoic seafloor spreading was at its most rapid. Given that the authors are postulating a rate of oceanic crust production up to 800,000,000 times greater than the present rate, one might have expected some acknowledgement that their chronology is problematic.[2] The same questions must, of course, be addressed by any scenario which puts the end of the Flood after the Mesozoic. Holt's suggestion (1996) that the Flood did not end until the Late Cenozoic only makes the problem worse.

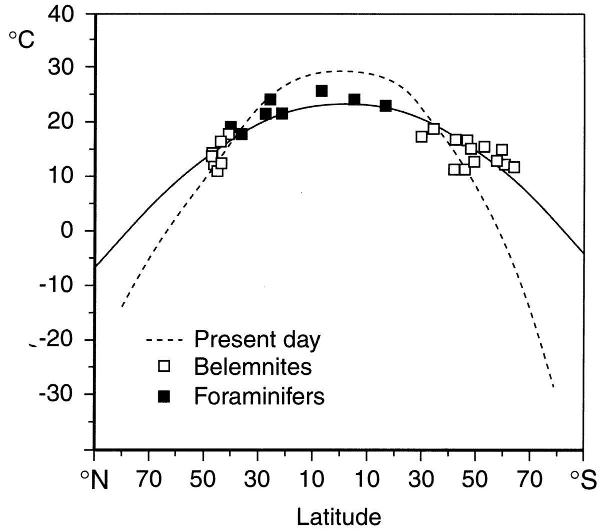

Figure 4: Mean annual ocean surface temperature gradient (solid line) as plotted from oxygen isotope ratios in belemnite and planktonic foraminifer shells of the mid-Cretaceous (latest Albian–Cenomanian). (After Sellwood et al.)

Furthermore, can we be confident that the upwelling of magma at the spreading centres would have raised sea levels sufficiently to inundate even the highest mountains, as Genesis records? Baumgardner estimates a rise of between 1,200 and 1,800 metres (1990), but quite possibly some pre-Flood mountains were much higher than 1,800 metres above sea-level. To meet this objection, one might counter that Precambrian topography rarely shows relative elevations of more than a hundred metres. Sloss (1988), for example, describes the surface immediately below the Cambrian transgression as, in many areas, a featureless plain:

> 'Commonly, however, where exposure or drilling density permit, abrupt local departures from a planar surface are seen as buried hills or are inescapably deduced from the facies and overlap relationships of basal Sauk [Cambrian] units. Paleotopographic relief, supported by differences in the resistance to erosion of petrologies at the unconformity surface, is commonly measured in tens of metres.'

Nonetheless, Genesis 7:19 speaks of 'high mountains', and the question which any Flood model needs to address is, how were those mountains reduced to the featureless peneplain of the sub-Sauk unconformity described above. Marine transgression at the rate of 2–3 metres per second (Austin, 1994) would not have eroded the mountains to base level.

The model is also unsatisfactory with regard to sedimentation. While the authors rightly observe that it may not be possible to derive all Palæozoic and Mesozoic sediments from igneous and/or metamorphic precursors by physical and chemical processes in the course of one year, is the solution to shift the production of vast amounts of catastrophically generated sediment to the pre-Flood era? Since the alternative of regarding Mesozoic sediments as post-Flood is ruled out because 'global-scale' sedimentation does not cease until after the Mesozoic, there would appear to be a certain degree of question-begging.

Indeed, what is meant by 'global-scale' sedimentation? The authors refer to 'a qualitative assessment of geologic maps worldwide', but such maps do not show global-scale sedimentation during the Mesozoic, except in the insignificant sense that all continents were receiving sediment somewhere. (The reader might like to consult the maps in *Origins* 11, p.11.) This is not an adequate approach to determining the Flood/post-Flood boundary! Since Mesozoic sedimentation patterns in no way testify to global inundation, the authors must surely have some better reasons for rejecting the possibility that the Mesozoic might be post-Flood.

Likewise, the authors imply that the period of ocean basin formation—the Mesozoic and Cenozoic—was simultaneously a period of globally regressing waters. Sheet erosion 'would be expected to have planed off a substantial percentage of the earth's surface', such as the planar erosion of the Kaibab and Coconino plateaus. But on a global scale the Mesozoic is a period of renewed transgression following the break-up of Pangæa (the supercontinent of Permo-Triassic time)—not regression. Worse still, that transgression was the direct result of the catastrophic plate tectonics postulated in their model! Hot magma surging through rifts buoyed up the mid-oceanic floors and displaced huge volumes of water onto the continental margins, sometimes deep inland. As a result of placing the Flood/post-Flood boundary much too high in the geological column, Austin *et al.* must postulate the very reverse of what is actually shown by the geological data. The regression and regional uplift which caused the erosion of the Kaibab and Coconino plateaus of Arizona occurred in the Tertiary (agreed to be after the Flood), not the Mesozoic (Austin, 1994, p.85).

The example of the Mesozoic, moreover, suggests—certainly in the context of a model which includes the Mesozoic in the Flood year—that catastrophic plate tectonics may not be sufficient to explain how the earth was completely inundated in the first 40 days of the Flood. As demonstrated by a vast and various body of evidence (*e.g.* Garner, 1996; Garton, 1996; Robinson, 1996a), there was never a time in the Mesozoic when the whole earth was under water—despite topography at that time being generally low and monotonous. Sea-level rise is not thought to have exceeded 300 metres (Hallam, 1992). If plate tectonics was an insufficient mechanism to cause global inundation in the Mesozoic, why should it be supposed to account for the inundation of even the highest mountains at any other time? (It is unfortunate that the authors do not say when they regard maximum inundation to have occurred.)

One would also wish to have seen the authors acknowledging in some way that 'the enormous explanatory and predictive success' which they hope to appropriate from plate tectonics in orthodox geology has to do with its success in accounting for mountain-building. The same process which is thought to have initiated a global deluge also thrust up obstacles—such as the Appalachians and Urals—in its path!

Finally, there is the question of sediment source. The authors suggest that the principal sources were (1) pre-existing oceanic sediments, including carbonate rocks, shell debris and quartz sands, and (2) the degassing of carbon dioxide and other volatiles from the oceanic spreading centres. An apparently negligible role is given to terrestrial or subterrestrial sources. These assumptions are, to some extent, geologically testable. For example, the Unkar and Chuar Groups of the Grand Canyon area (both Precambrian) are interpreted by Austin *et al.* to be shelf sediments accumulated during Creation Week and the period before the Flood (1994, p.62) (see Figure 5).

The Unkar Group comprises: sandy limestone and interbedded shales, with some conglomerate; up to 1,000 feet of shale intruded by igneous dikes and sills; 1,200 feet of quartzite, often cross-bedded, and with large fluid evulsion structures evidencing extremely rapid deposition; over 3,100 feet of siltstone and shale, also intruded with dikes and sills and showing fluid evulsion structures; and a considerable thickness of basalts and 330 feet of sandstones. Current indicators in the sandstones suggest that sediment was transported from the east, *i.e.* had a continental source. The Unkar Group is therefore attributed to the separating out of the dry land on Day 3 of Creation Week and to residual accumulation thereafter.

The overlying Chuar Group comprises: up to 4,200 feet of shale and limestone, with minor amounts of sandstone; up to 2,200 feet of shale and sandstone, with minor amounts of dolomite and chert; and 120 feet of sandstone interbedded with breccia containing blocks from the stratigraphically preceding formation. Again, the sedimentation seems to have proceeded from the east. Immediately above the Chuar Group is the Great Unconformity, when the first deposits of the Cambrian transgression appear. Along with the breccia, these are understood by Austin and Wise (1994) to represent the first Flood deposits.

Stromatolites occur in the Chuar Group at three major levels, some of them growing as high as 12 feet. Since they are not unlike the stromatolite mounds in modern-day Shark Bay, Australia (a very unusual and hostile environment), they are understood to indicate different levels of pre-Flood ocean floor. 'Evidently, a shallow ocean covered northern Arizona before the Flood, and a remnant of the sea floor is preserved.' (Austin, 1994, p.65)

However, these *in situ* stromatolites are the only evidence which could be taken as supporting this interpretation, and Shark Bay is not an environment typical of either a modern or, one supposes, a pre-Flood seafloor; indeed, the stromatolites occur in the intertidal zone, not (as the analogy requires) offshore.[3] The Chuar Group contains no biogenic calcareous ooze or shell debris, such as one would expect of a seafloor (or succession of floors). Equally, one searches in vain for the fossils of trilobites, brachiopods and other creatures, catastrophically buried by the events that caused up to 6,600 feet of deposition. Is it reasonable to attribute to the period between Creation Week and the Flood thicknesses of sediment equal to the depth of the Grand Canyon itself?

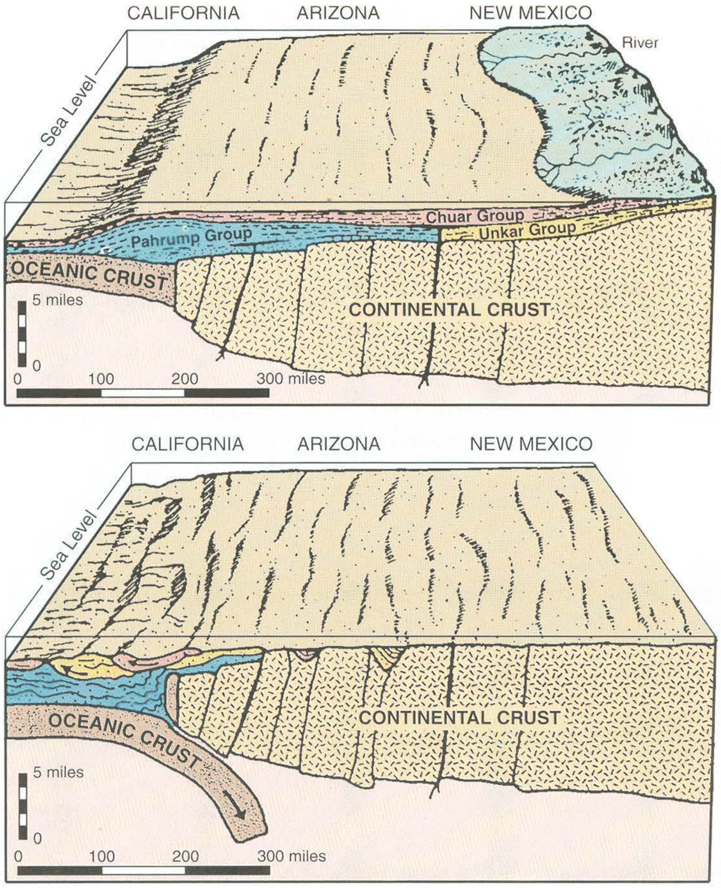

Figure 5: Above: *The continental margin of the southwestern United States on the day before the Flood began, as visualised by Austin and Wise.* Below: *Deformation of the continental margin early in the Flood in response to oceanic crust subduction.*

Austin asserts, 'Evidently, as the Flood began, the Precambrian strata in the eastern Canyon [the Unkar and Chuar Groups] were downwarped into a huge, north-trending trough structure ('syncline'), which lowered them into the earth to the extent that subsequent Flood erosion did not completely remove them.' (Austin, 1994, p.66) But it is only the objection that Flood erosion would be expected to have removed them that makes this statement evident. Geologically, it is not difficult to distinguish deposition followed by downwarping from deposition occurring at the same time as downwarping: what does the stratification of the Groups actually tell us?

The cart before the horse?

Although the authors are careful not to take a definite position on where the pre-Flood/Flood boundary lies, except to say that it must be lower than the Cambrian, it would seem essential that a fairly definite position—as a result of considering the data—should be taken before developing a model which purports to account for the entire geological record in terms of a pre-Flood, Flood and post-Flood sequence. Since catastrophic plate tectonics explains the total inundation of the earth in the first 40 days of the Flood year by reference to marine inundation, the model is virtually committed to putting the pre-Flood/Flood boundary where global marine transgression first begins in the record, namely at latest Precambrian (Eocambrian). As we have seen with regards to the Grand Canyon, such a boundary causes difficulties when seeking to interpret strata which lie beneath the transgression. A methodologically preferable approach would surely be to consider first whether the earth was not already under water by latest Precambrian. For example, is there any evidence (particularly inland, where erosion may have been weaker) that the marine waters were transgressing upon a pristine land surface?

Indeed, Snelling—one of the authors—has argued that the Flood was responsible for a large part of the Precambrian, possibly most of it, so that the pre-Flood/Flood boundary would be much lower than the base of the Sauk (latest Precambrian upwards). He has explicitly suggested this in relation to the Grand Canyon (1991). How can such a view be reconciled with the proposed model of catastrophic plate tectonics, in which the beginning of the Flood is equated with marine transgression?

Similarly, the authors 'tentatively' place the Flood/post-Flood boundary at the end of the Mesozoic, as if it were feasible to develop a comprehensive Flood model before fixing that boundary (no case for putting the boundary at that point has ever been published). Again, we have seen that fixing that boundary at the end of the Mesozoic results in a model which is fundamentally at variance with the geological record, even though the model is designed to elucidate it.

Regardless of the specifics of Flood chronology, Baumgardner's theory of catastrophic plate tectonics needs to be compared with and tested against the expectations of uniformitarian plate tectonics. Possibly the area in which the latter is most open to challenge is the connection drawn between the rates of crust production which are inferred from the radiometric timescale— 4–7 cubic kilometres per year (Gaffin, 1987)—and the independently inferred rises in sea level. It may be doubted that rates of crust production little more than double the present rate could have resulted in sea-level rises of up to 300 m. With spreading rates in the order of centimetres per year, would not the more recent crust at some distance from the spreading centres have been in thermal equilibrium between the colder water above it and the warmer magma beneath it? There is also the related problem of a vast time-lag between the higher rates of crust production and their expression in higher sea-levels (Figure 6). The time-lag would appear to be the effect of new crust forming at a faster rate than the rate at which it reached thermal equilibrium, so that mean seafloor level rose cumulatively.

Uniformitarian plate tectonics also appears vulnerable in the area of mountain-building. A tectonic velocity of 11 cm per year (0·0000000125 km per hour) is unlikely to produce the momentum required to account for the Himalayan crumpling of Asia's underbelly when India

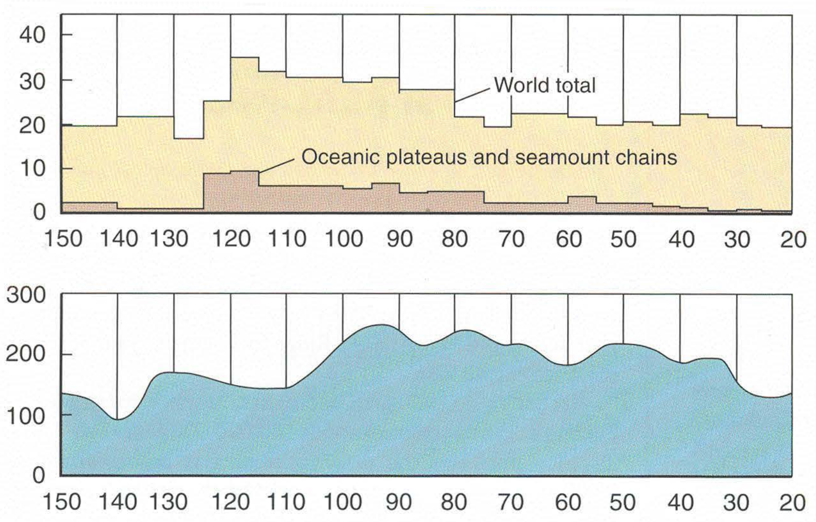

Fig. 6. Geological effects of rapid ocean-floor spreading from the Early Cretaceous to Early Miocene. Above: *oceanic crust production expressed in millions of cubic kilometres per million years (radiometric scale).* Below: *inferred sea-levels over the same period in metres above present sea-level. The close correspondence suggests that sea-levels rose and fell in response to the changing rates of oceanic crust production. However, if the radiometric scale represents real time, the phase-lag of approximately 20 million years is unimpressive. (From Larson, 1995)*

collided with the continent during the Tertiary. In addition, there are again time-lag problems for the old-earth model. As a result of the collision it is thought that mantle-derived granites were still being emplaced in Pakistan 20 million years after the orogeny which altered other rocks in that region (Butler, 1995). Orogeny continued as a result of the collision until well into the Pliocene, more than 50 million years later. The Himalayas are still perceptibly rising today.

In conclusion, Baumgardner's research into runaway subduction may well prove of enduring value in explaining how post-Palæozoic plate tectonics can be explained within a young-earth framework. Regrettably, the research has not been conducted in that context. Instead, catastrophic plate tectonics has been offered, and adopted by the other five authors, as the key to understanding the whole geological record. In my judgment it does not provide such a key. On the contrary, the model which they have built upon catastrophic plate tectonics seems to be yet another instance of creationist geologists working from preconceptions about the Flood and imposing them on the data, rather than allowing a potentially fruitful idea to be tested by the data. How else, for example, can one explain the statement that sedimentary units throughout the record tend to be thick, uniform, and of unknown provenance? This is simply not a valid generalisation.

In a letter to the editor of *Creation Ex Nihilo Technical Journal*, Molen (1995) referred to the paper of his (1994) which highlighted the heat problem. Replying as a contributor to the catastrophic plate tectonics model, the editor did not acknowledge the problem, but referred to unspecified difficulties which were not to 'be interpreted as a sign of weakness while ever the model is so eloquently consistent with so much observational data'. He and his colleagues looked forward to refining their theory further, 'to make it even more comprehensive and powerful in explaining the geological record from a biblical perspective'. The authors have since affirmed that they would be happy to deal with substantive critiques of their theory (Austin *et al.*, 1996). It is to be hoped that they will do so without being overly confident of its explanatory power.

Notes

1. This article represents in part a correction of my inaccurate summary of their paper in *Origins* 8:20, for which I apologise to the authors concerned.
2. Although the problem is considerably diminished if the Mesozoic is understood to be post-Flood, it remains formidable. At the moment, all young-earth Flood models are obliged to assume much more rapid cooling rates than are known to present-day physics. Thus, the suggestion that earth expansion may have absorbed some of the heat may be worth further consideration. Evidence for such expansion might include the extensional tectonics of Upper Precambrian rifting and the overall fall in Phanerozoic sea-levels.
3. *In situ* stromatolites occur throughout the Phanerozoic. If a substantial part of the Phanerozoic is to be attributed to the Flood, they cannot therefore be understood as diagnostic of stable conditions.

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RATES OF SEAFLOOR SPREADING

The theory of plate tectonics can claim direct support from high-precision measurements of spreading rates, using the techniques of Satellite Laser Ranging (SLR) and Very Long Baseline Interferometry (VLBI). It is uncertain, however, whether the measurements represent sustained long-term trends (Snelling, 1995). Rates vary from about 1·5 cm per year across the Mid-Atlantic Ridge to 17 cm per year across the East Pacific Rise.

According to old-earth geologists, North America and Europe began to separate about 180,000,000 years ago. The distance between the two continents is approximately 5,000 km, giving an average spreading rate over that time of 2·8 cm per year (1·4 cm in either direction). This accords rather well with the present measured rate. If the same area of ocean floor was formed in 5 months, the average spreading rate would be 12,166 km per year. On the basis that oceanic crust production is roughly proportional to spreading rates, Austin *et al.* are therefore postulating an oceanic crust production rate up to 800,000,000 times greater than present rates.

As recognised by those authors, the effect of such enormous rates would be to raise the level of the ocean floor and inundate the continents, thus reducing the mean depth of the oceans. The mean depth of the present Atlantic is 3,800 m. If the pre-Flood ocean had the same depth and the depth was reduced at the spreading centre by two thirds (Baumgardner estimates a reduction in the mean depth of ocean basins of between 2,000 and 3,000 m), the transfer of the heat energy in just 100 m of fresh magma would raise the ocean's temperature by some 80°C! (Molen, 1994, assuming instantaneous heat transfer). The thickness of normal ocean crust in the Pacific, for example, is 6·5 km. Over five months the heat energy from far more than 100 m would have been transferred to the atmosphere and water.

At high rates of lava outflow, water and lava mix explosively (Colgate & Sigurgeirsson, 1973). At lower rates, the lava is prevented from cooling rapidly by the formation of a crust. Once a competent crust is formed, the heat loss from the crustal surface tends to be governed by the thermal conductivity of the crust rather than by the rate of heat exchange at the lava surface.

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Reviews

A New Look at an Old Earth. What the creation institutes are not telling you about Genesis, by Don Stoner. Schroeder Publishing, Paramount, California. 1992. 192pp.

Reviewed by Paul Garner.

AS a recent survey published in *Origins* confirmed, there are many Christians today who oppose the concept of biological evolution, yet are reluctant to stand against the geological consensus that the earth is extremely ancient (some 4·6 billion years old) (Bell, 1994). No doubt many of these believers regard the age of the earth as a trivial side issue. It is common to hear Christians say that the important point is that God created the world, not when He did it. I suspect that many of these sincere believers maintain this view because they have not really thought through the theological and doctrinal implications of the old-earth position. Numerous authors have convincingly shown that belief in a billion-year-old earth, with its corollary of a fossil record of death, suffering, and catastrophe pre-dating the arrival of man, has very great significance for our understanding of the gospel message itself (for example, Ham and Taylor, 1988). The age of the earth is also not a trivial issue for Christians in the geological sciences who are concerned to build a coherent and satisfying model for earth history that is consistent with God's written revelation. Although I found myself disagreeing fundamentally with Don Stoner's position in *A New Look at an Old Earth*, his book does compel us to confront these issues head-on and think seriously about our position.

Don Stoner's thesis is that by advocating an earth no older than 10,000 years, young-earth creationists have introduced a dangerous error into the thinking of the church. Although in his first chapter Stoner says that he desires 'to remain as much at peace with [his] brothers as is possible', and that his goal is 'to restore unity, not to fuel division' (p.18), he uses some inflammatory language at times. He accuses young-earth creationists of 'an ill-fated attempt to conceal the true age of the universe' (p.150) a claim which seems to suggest a campaign of calculated deception, although in another place he says he 'does not believe that the men who have presented these arguments are deliberately trying to misrepresent the facts' (p.88). Quoting Romans 10:2 he says that young-earth creationists have a zeal for God but one which is not according to knowledge (p.150). The writings of young-earth creationists are characterised as containing 'fiction from cover to cover wherever the subject of dates occurs' (p.151). The concept of a 10,000-year-old universe is even described as 'a fairy tale' (p.152). Young-earth creationism is, he concludes, a stumbling block that prevents informed and educated people from being receptive to the gospel.

What is the reader to make of all this? We ought to acknowledge that there is an element of truth in some of what Don Stoner says. Young-earth creationists have often failed to take seriously Jesus's requirement that we attend to the plank in our own eye before removing the speck from another's. There is a tendency in some quarters of the creationist community to resort to ridicule of our opponents, rather than to respond in love and humility. We are called to always be ready to give a reasoned defence of what we believe, but we are to do so 'with meekness and fear' (1 Peter 3:15). Sadly, Don Stoner is right that we have often been careless and lacked the conscientiousness we should have shown in checking our arguments before using them (p.88).

But does the case presented in Don Stoner's book warrant the abandonment of young-earth creationism? I do not think so. The young-earth view still appears to be the one that is most faithful to Scripture, and the one that makes the most scientific sense. In fact, many of the errors Stoner lays at the door of creationism are evident in his own book. For instance, Stoner accuses creationists of relying on 'obsolete' sources for their young-universe arguments (*e.g.* pp.79–85 on moon dust). Yet few of the creationist books cited by Stoner were published after the 1970s, and in many cases these older publications have been superseded by more recent material of which Stoner appears to be unaware.

Take, for instance, his brief critique of Thomas Barnes's young-earth argument based on decay of the earth's magnetic field (p.99). Stoner here cites a 1973 monograph as though it represents contemporary creationist thought, with no acknowledgement that events have moved on in the last 23 years. He chides young-earth creationists for not accepting magnetic field reversals, obviously unaware that creationists not only acknowledge such reversals (Humphreys, 1988), but have, in fact, proposed a physical mechanism for the reversal process that has proved successful in predicting new scientific discoveries (Humphreys, 1990). Most geologists have come to believe that each magnetic field reversal recorded in the rocks, of which there have been at least fifty in the earth's past, must have taken long periods of time (thousands of years). If the creationist model is correct, each reversal must have taken place much more quickly than this, perhaps on a time scale of only a few days or weeks. In 1986 Dr. Russell Humphreys predicted that if this were true then it could be confirmed by finding a thin lava flow that had cooled within a few weeks, yet which contained at least one reversal (Humphreys, 1986). The confirmation Dr. Humphreys was looking for came in 1989 when two respected palæomagnetists identified a basalt lava flow at Steens Mountain, Oregon, which recorded a polarity transition that had taken place in about a fortnight (Coe and Prevot, 1989). Subsequently, this find has not only been confirmed, but it has been realized that the transition took place even faster than at first thought! (Coe, Prevot, and Camps, 1995). It is not clear why Stoner has failed to address such matters in his book. It may be that he is simply not as familiar with up-to-date creationist literature as he implies. However, Dr. Hugh Ross who contributed the foreword to Stoner's book, is certainly aware of these developments because he was sent Dr. Humphreys's papers, and acknowledged receiving them in a letter dated July 17 1991 (Van Bebber and Taylor, 1994). It can only be hoped that subsequent editions of this book will be revised to reflect contemporary creationist thinking on this subject.

There are many other such examples in the book. Stoner draws attention to laminated sediments which geologists believe represent annual layers or varves (pp.78–9). He claims that the four million varves of the Green River Formation (Eocene) of Wyoming are clear evidence that this deposit alone took millions of years to be laid down, and states baldly that there 'is no easy way to misunderstand the evidence' (p.79). However, the varve interpretation (for that is what it is) has now effectively been falsified in the secular literature. Geologists identified two volcanic ash layers in the Green River Formation, each of which was laid down essentially instantaneously. If the varve interpretation of the Green River Formation is correct, then the number of mud layers between the two ash layers should be the same everywhere throughout the depositional basin. In fact, the number of layers increases by up to 35% from the basin centre to the basin margin, representing a serious challenge to the varve idea (Buchheim and Biaggi, 1988). Creationists are able to point to a large body of experimental and observational data that shows that varve-like sediments can build up very rapidly under catastrophic conditions (Austin, 1994; Oard, 1992a, 1992b). None of this information is discussed or even acknowledged by Stoner. Similarly, no work by creationists on tree ring dating is mentioned (pp.77–8), even though many papers have been published on this subject (Aardsma, 1993; Beasley, 1993; Clementson, 1974; Gladwin, 1978; Lammerts, 1983; Wiant, 1977). A recent comment by Porter helps put tree ring dating in some kind of perspective:

> 'Most dendrochronologies have never been published in any detail, so it is impossible for an outsider to check the method or the figures. I would suggest that for all important chronologies there should be publication of ring width indices for each local chronology and the statistics linking the local chronologies. This would not require a vast amount of journal space. Until this has been done a chronology cannot be regarded as 'published' let alone proven' (Porter, 1995).

Stoner claims that creationist arguments for young age based on the amount of salt in the oceans consider influx rates only, and neglect output processes (p.99). This is simply not true. A 1990 paper by creationists Austin and Humphreys reviewed all known input and output mechanisms, and concluded with an upper age limit for the oceans at least fifty times younger than old-earth proponents require it to be (Austin and Humphreys, 1990).

Stoner follows the approach of Hugh Ross by making a great appeal to astronomical evidence in favour of an extremely ancient universe. In particular he discusses what he regards as the failure of young-earth creationists to resolve the conflict between the travel time of light in space and a young age for the universe. He outlines three possible young-earth responses to this problem—a small universe, decay in the speed of light, and light created in transit—claiming that there 'are simply no other reasonable possibilities' (p.72). Knocking each one down in turn, he draws his conclusion that the universe 'is certainly very old' (p.73). However, it is incorrect to state that there 'are simply no other reasonable possibilities'. Stoner has missed at least two others—the curved space theory (Slusher, 1980) and Humphreys's relativistic white hole cosmology (Humphreys, 1994). It is understandable that Humphreys's model is not discussed, since that was only published in 1994, but the curved space theory—whatever one may think of its validity—has been around in the creationist literature for many years. Significantly, Hugh Ross rejected an invitation to review Dr. Humphreys's model pre-publication and has declined to debate Dr. Humphreys on radio since it was published (Anon, 1995). Humphreys's model may turn out to have flaws of its own, but its recent introduction should teach us that it is premature and unwise to claim that there is no explanation for distant starlight in a young universe simply because we haven't thought of it yet. If we lack a solution to this problem it may be because we are fallible, fallen, limited human beings who don't have all the answers—and never will this side of eternity!

Stoner's book represents a serious failure to address modern creationist literature, in which there are encouraging signs that a more healthy self-criticism is developing. The more flaky arguments and evidences associated with creationism—and on which the truth of creationism depends not one iota—are being refuted by young-earth creationists themselves (DeYoung and Rush, 1989; Frair, 1993; Robinson, 1996; Snelling, 1995; Snelling and Rush, 1993). In fact, as one evolutionist recently acknowledged, 'creationists criticize other creationists more strongly and more accurately than their opponents do' (Lippard, 1994).

More serious even than Stoner's selectivism when discussing scientific issues is his whole approach to Scripture. Although he might not see it this way, it seems clear that when Stoner uncovers an apparent disagreement between 'science' and Scripture, it is virtually always Scripture which has to succumb to reinterpretation. Stoner regards the testimony of God's creation to be much clearer than that of God's word. In his chapter on understanding Genesis chapter one, he says:

> 'While it will be comparatively easy to decipher what God's creation is telling us, it will not always be so simple to grasp exactly what His Bible is saying here' (p.103).

Surely this puts the situation completely the wrong way round? What does such a view imply for our belief in the perspicuity of scripture? Genesis is left at the mercy of fallible and biased scientific theories, some of which next year may have been modified or even completely abandoned! Towards the end of the book, the author's attempt to harmonise the Genesis account with the secular old-earth view leads him into a hermeneutical morass in which we have overlapping creation 'days' with 'indefinite edges' (p.121), each millions of years long. Why must the creation 'days' overlap? Stoner is candid in admitting that it is because of instances 'where the scientific information demands this' (p.121). John Morris has rightly described this approach as 'manipulative gymnastics' by which the scriptural account can be made to mean just about anything one wants it to mean (Morris, 1994). Morris points out that a similar scenario of overlapping creation 'days' was once advocated by old-earther Davis Young, but he has since given up this approach, claiming now that 'we will be on the right track if we stop treating Genesis 1 and the flood story as scientific and historic reports' (Young, 1987). This is where the compromise road eventually leads—to a rejection of Genesis as genuine history. I would suggest that a better understanding of Genesis chapter one is advanced by authors such as Stambaugh (1991) and Hasel (1994).

The book also leaves serious questions unanswered. If the rocks and fossils are the record of billions of years of pre-human history, then where is the record of the global Flood described in Genesis 6–8? Although the subject is not addressed, I suspect the author would appeal to a local Flood or a tranquil Flood theory—neither of which makes biblical or geological sense. Also, the author places so much emphasis on the supposed concordance of Genesis with the Big Bang theory, that one wonders what would happen if the Big Bang were ever rejected by secular cosmologists. In addition, a host of disturbing theological, historical and scientific problems (Lubenow, 1992) are raised by Stoner's proposal that the Neanderthals were sub-human, soulless ape-men that co-existed with Adam and his immediate ancestors (pp.135–9). To conclude, this book is a profoundly unsatisfying attempt to harmonise the secular view of the age of the earth with scripture. Its science is too naïve and out-dated for it to act as the corrective to young-earth creationism that Stoner intended, and ultimately the author raises more problems than he provides answers.

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Running out of Time—a critical review of evolution, creation and consummation, by Graham Wilson. The Rowans Press, Gullane, East Lothian (1995); 144 pages. ISBN 0952 488 40X. £5·00.

Reviewed by J. H. John Peet.

THIS little book is written in a popular and non-technical manner. It is easy in its style. Besides the central theme of Creation and Evolution, Graham Wilson tackles the equally controversial areas of prophecy and the end times. It is a review of earth history from the Creation to the consummation, including a look at the Noahic Flood and Israel. Probably few will agree with the author on every point, but it is lucidly written and is refreshing. I agree with the comment of Geoffrey Grogan in the foreword: 'It is a good read.'

In his attempt to keep up to date, Mr. Wilson fell into the trap that many of us find of quoting new finds before they have been evaluated. So, for example, the reference to the supposed forgery of the Alpian Ice Man (p.14) was a hoax in itself and the Russian dinosaur (p.136) turned out to be a non-event too. However, he does emphasise rightly the spiritual cost of atheistic evolution. Occasionally he makes comments that I'm not certain are quite correct: did the Flood affect radioactive decay rates? (p.25) and was the Flood at least 6,000 years ago? (p.41). There is some doubt about the discrepancy in the carbon-14 production and decay rates (38%, p.122); earlier work estimated it at nearer 16%. Similarly, with modern technology carbon-14 can be detected beyond 50,000 years. (The deviation in rates would affect the calculations of these dates and reduce them markedly). Nor am I persuaded that the ten tribes of Israel were taken into exile 'never to return' (page 89). However, these corrections do *not* imply that the book is fundamentally flawed—it is not—and should not discourage folk from reading it.

[Mr. Wilson has kindly offered to make a contribution to the *Biblical Creation Society* from each copy sold. Purchase your copy directly from the author at 8 The Rowans, Gullane, East Lothian, EH31 2DU, mentioning the Biblical Creation Society.]

Are You Being Taken for a Ride? Part One: 'Is Evolution Possible?'. Joyce Nevin. Published by author in August 1993, 93pp. (A4 format). £3·00.

Reviewed by Dr. A. J. Monty White.

I KNOW from personal experience how difficult it is to get one's work published and how great is the temptation to publish it oneself. However, I believe that it is always a good idea to try to get one's work published by a reputable publisher because it helps the author to answer questions such as: What is the purpose of the book? For whom is it written? Is the material new or is it presented in a novel way? How is it best to present the material? and so on. It is with these questions in mind that I approached the task of reviewing Joyce Nevin's publication.

I was initially put off reading this work by the fact that it is A4 duplicated (and not to a very high standard—many of the photographs do not reproduce well) and held together with a slide binder! I began to think about how I would feel if I decided to give this publication to a non-believing friend. However, bearing in mind that one should not judge a book by its cover (nor its reproduction and binding, in this case), I proceeded to read it.

Although entitled 'Is Evolution Possible?' the introduction is in fact nothing at all to do with this question, but is a short description of the complexity of life on earth and the position our planet has in the universe. I recalculated some of the author's sums which determine how long it would take to get to the nearest star travelling at various speeds and found that I did not get the same results—our answers differed by a factor of 10.

The author then examines the question 'Is Evolution Possible?' in the light of what she calls the 'four established laws of science' in four unequal chapters: Chance or Design? (7pp.) Improvement or Degeneration? (6pp.) Life Comes From Life (4pp.), and Like Gives Rise to Like (60pp.).

The first chapter compares evolution with science in regard to the production of complex things. The author maintains that science says 'Matter + Energy + Information = Complex Things' while evolution says 'Matter + Energy + Time + Chance = Complex Things'. The author then compares the Big Bang hypothesis of the origin of the universe to an explosion in a print works producing a neatly typed (and bound) Bible. The Solar System is likened to a watch with the question posed: Do explosions in a jewellery shop create clocks and watches? Two pages are devoted to a good critique of the Big Bang hypothesis. The conclusion to this chapter is that one cannot equate Time + Chance with Information and that Information has to come from an 'Intelligent source'.

The second chapter is devoted to the second law of thermodynamics which determines that disordered states and simple systems evolve naturalistically into ordered states and complex systems. The whole chapter is devoted to the so-called Cambrian explosion. The author accepts uncritically the geological column and then argues that the explosion of complex life-forms found in the Cambrian strata disproves evolution. I was perturbed at the statement that 'no undisputed fossils have been found' in the Precambrian Rocks. No evolutionary geologist and few creationists would agree with this—for example, there appears to be indisputable evidence that fossil stromatolites have been found in Pre-Cambrian Rocks.

The erroneous idea of spontaneous generation is dismissed quickly in the third chapter, which is entitled 'Life Comes From Life'. However, the author then states that the chances of amino acids forming proteins is equal to zero, but there is no criticism of the laboratory experiments which purport to demonstrate that amino acids *do* form proteins under conditions which are thought to have existed on the pre-biotic earth. It is also a pity that the author did not discuss the dilemma: Which came first, DNA or protein? The usual statement made by Professors Sir Fred Hoyle and Chandra Wickramasinghe about the probability of a living cell forming by chance is the same as a tornado passing through a junk yard and assembling a Boeing 747. However, the author gives no explanation of *why* these two scientists have concluded this—because of the amount of *information* that is found in a living cell. Similar analyses and examples have been produced by Dr. Wilder-Smith and I was disappointed that he was not mentioned as he is a brilliant biochemist and a creationist to boot!

The fourth chapter 'Like Gives Rise to Like' is by far the longest chapter and is divided into two sections. The first asks the question, How did evolution take place? In seven pages, and by reference to natural selection, gene pools, Darwin's finches, pigeons, peppered moths, and mutations in fruit flies, the author concludes that 'no mechanism for evolution has been found'.

The second section is 52 pages long (that is over half the length of the book) and is devoted to answering the question, Is there any evidence for evolution? The author relies heavily on the fossil record of animals and plants (10pp.) and that of ape-like creatures and humans (40pp.) in order to conclude that 'there is definitely No *(sic)* evidence of monkeys changing into men'. This section relies heavily on the work of Malcolm Bowden, reproducing many of his arguments regarding Java Man, Peking Man and Piltdown Man.

I did not enjoy this book. I got the distinct impression that the author is not sure for whom she is writing—I found that sometimes the author thought she was addressing creationists (and so did not have to argue her case) and at other times she thought she was arguing with the convinced evolutionist (and so went into great detail concerning the point she was trying to make). Although it seems to start out as being an introductory book on origins, after the second section of the fourth chapter, it seems to lose this initial direction and becomes far too involved about the origin of humans, in particular, for an introductory work. I could see no point in this book—there is nothing new in it and old ideas and arguments are not presented in any new way. If you are looking for an introductory book about origins, then you would be better off with Sylvia Baker's introductory book, *Bone of Contention.* It is better written, excellently reproduced and 50% cheaper!

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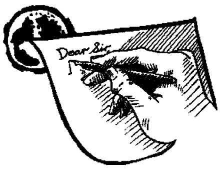

Correspondence

Our mailbag usually brings very supportive mail. This year we have had some letters giving the other side of the coin. Do let us know your thoughts—even if we cannot please everyone!

W. J. Fleming

I agree with Mr. Gilbert who wrote in a recent issue of *Origins.* You should be including more generalistic articles on Darwinism and Creation Science. Could I go further and say that your Society should be open to people who have a general sympathy for the biblical account of creation.

I was rather taken aback when I obtained your leaflet and read the ten point doctrinal basis of your society. I am very interested in promoting creation science but do not want to accept all this theology, little of which I can agree with. I am, therefore, precluded from an organisation I wish to join.

There must be many people like me. Some like myself will not be Christians. Some will be Christians who will have a disagreement about one or more of your doctrinal points. Surely you should not make this difficult. Open up your organisation and let us unite to help defeat the Darwinists.

To finish, could I just say that you do produce a very professional quality magazine which I will continue to read and subscribe to. It does help a lot. So keep up the good work.

Mrs. Vivian Blakely

I am glad that there are people like yourselves who *know* that the concept of evolution is wrong and who know how to answer the critics of Biblical Creationism.

The Rev. B. R. Talbot

I wish God's blessing on your ministry in this vital work ... Most christians only need a little evidence from Christian scientists to overcome the false impressions put across by evolutionists. We praise God for all those involved in upholding Biblical truth in this matter.

Queries and Comments

q: How do young earth creationists account for the fact that igneous rocks must have cooled in just a few thousand years? Don't they require millions of years to form?

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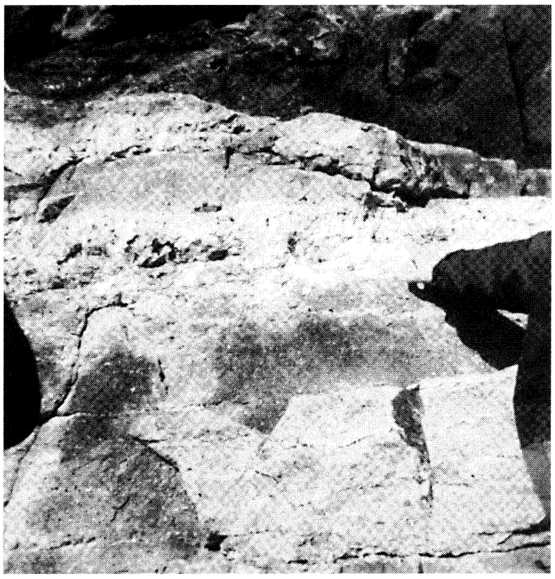
a: Igneous rocks are those which have formed by the cooling of molten material, either on the earth's surface (*e.g.* lava flows) or below the earth's surface (*e.g.* sills, dykes, batholiths). Flows on the earth's surface are called extrusive, and those that form within the earth are called intrusive. Several critics of creationism have argued that the cooling rates of igneous rocks contradict the notion that the earth is only a few thousand years old (Hayward, 1985; Young, 1977).

Igneous cooling times are certainly a significant problem for young earth models. However, we should remember that other geological phenomena have been thought just as intractable in the past, yet answers have been forthcoming upon investigation. Past experience teaches us that we should be very hesitant before we proclaim any phenomenon as proof positive of an old earth. The bulk of the scientific evidence supports a young age for the earth (Morris, 1994), and we should build our models on the majority of the data, while seeking alternative explanations for the 'anomalies' which seem not to fit. Research on this subject of cooling times for igneous bodies is still in progress, so a full answer is not yet available. However, some initial comments can be made.



The contact between the top of the south west England granite batholith and the surrounding country rock exposed at Porthmeor Cove, Cornwall. [Photo: Paul Garner]

There seems to be little difficulty in forming lava flows in short time scales, provided the lava is in contact with a cool enough environment (Wise, 1986). It is noteworthy that rainfall can greatly accelerate heat loss from the surface of lavas. Williams and McBirney cite a study which found that heavy rains, totalling 4·44 inches in a period of 6 days, lowered the temperature profile of a Hawaiian lava by about 50°C to a depth of about one metre (Williams and McBirney, 1979).

Dr. Andrew Snelling (1991) has shown that relatively short time scales are also sufficient for the cooling of thin intrusive bodies, such as dykes. Even for a granitic dyke 10 metres wide the time to crystallization is only of the order of 1·6 years, and cooling to ambient temperatures is completed in about 9 years. Other investigators have shown that the transport of material in dykes is an extremely catastrophic process occurring at explosive velocities, sometimes approaching the speed of sound in rock (Szekely and Reitan, 1971). Relatively short time scales also appear to be sufficient to account for sills and laccoliths. Fridrich and Mahood (1984) describe how catastrophic magma injection along a vertical piston fault surrounding the Lincoln Gulch stock resulted in the forceful emplacement of three resurgent sill-like intrusions. Field evidence indicates short solidification times for all three bodies. A study of 200 laccoliths in the southwestern United States led to the 'inescapable conclusion ... that laccoliths are emplaced instantaneously on a geologic time scale.' (Corry, 1988). According to this study, laccoliths are typically emplaced within a single year, and never take longer than 10 years to form. Cooling also occurs in approximately one year. In this same report, two case histories are described where rapid laccolith growth was directly observed in historical times at Usu-san, between Sapporo and Hakodate on Hokkaido Island, Japan. Rapid intrusive processes are also indicated by 'sedimentary structures' in igneous rocks—including graded bedding similar to that in turbidites, slump features, and load casts (Irvine, 1964).

When estimating the cooling times for larger igneous bodies, such as granitic batholiths (or plutons), it is generally assumed that conductive heat loss predominates. However, there is evidence that convective cooling has played a more major role than is usually assumed, and this would mean that cooling was more rapid than current estimates imply (Tyler, 1982a). It is also significant that experimental and theoretical research by petrologists has shown that plutonic textures can be formed in short periods of time (Tyler, 1982b). Plagioclase, orthoclase, and quartz have been grown in crystal forms and sizes characteristic of granite (Mustart, 1969; Swanson, 1977; Swanson, Whitney and Luth, 1972), plagioclase zoning (Lofgren, 1974), comb-layering (Lofgren and Donaldson, 1975), and mafic-before-felsic crystallization (Naney and Swanson, 1980) have all been simulated in the laboratory. Swanson (1977) argues that the rapid crystallization of feldspar and quartz in these experiments 'suggests re-evaluation of the length of time required to produce the large crystals of the granitic rocks' (p.974). Finally, unequivocal field evidence shows that the Tatoosh pluton of Mount Rainier National Park was rapidly cooled at shallow depth, in spite of its granitic texture (Fiske, Hopson and Waters, 1963). This is in direct conflict with the orthodox idea that coarse-grained plutonic bodies cool slowly at great depths.

Much work remains to be done, and this is only a preliminary answer at best. Wise (1986) has made a number of suggestions for future creationist research on this topic. However, it would be ill-advised to dogmatically rule out a young earth on the basis of our current knowledge in this field.

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q: How do young earth creationists explain the absence of mineable quantities of radionuclides like plutonium if the earth is young?

a: The problem described by our enquirer can be outlined as follows. Plutonium has several isotopes. The longest-lived isotope has a half-life of nearly 66,000 years. This means that it should be detectable for up to half a million years or so after its formation. In contrast, uranium-238 would last for up to 450,000 *million* years. If the earth is very old, say 4,000 million years, then uranium would be detectable but not the plutonium which would have died away long ago. On the other hand, in a young earth both elements would still be around. This problem applies to a number of other isotopes.

Several points can be made in response to this question. First of all, we need to ask the very basic question: Why do we expect to find these isotopes? Who says they *should* exist? It is a deduction made from the evolutionary scenario for the origin of the earth - not from a biblical account of creation. It is worth noting that *no* element of atomic number greater than uranium (and that includes plutonium) exists naturally.

A major problem would exist with these short-lived isotopes: the shorter the half-life, the greater the radioactivity. Might it not be, therefore, that the all-wise Creator did not create them because of the hazard arising from such dose levels? Woodmorappe (1983) has pointed out that most of these isotopes form more water-soluble compounds than do those of the uranium-lead series. They would, therefore, be easily leached from the parent rocks by groundwater and geochemically concentrated into biologically hazardous 'hot spots'.

Further, if a mineable supply of plutonium had existed, that rock would now contain mineable sources of the decay products of the plutonium. As far as we can ascertain, no such deposit exists and so we ask whether it ever did exist.

Another possible explanation is that the radioactive decay rates were higher in the past and so these isotopes would have disappeared by decay. Though this would be a natural corollary of the Setterfield scenario on the decreasing speed of light, we are unconvinced by his model (Peet, 1990; Reeves, 1992). We understand that Russell Humphreys is proposing an alternative model (presumably arising from his study on star-light travel and the age of the earth) which will appear in an imminent issue of *Creation Ex Nihilo Technical Journal.* If, for example, during the Creation week the speed of light was much greater than at present (perfectly consistent with a miraculous Creation act), then both the time taken for star-light to reach the earth and the decay period of these isotopes would be adequately explained. It is probable, though, that this will not be experimentally determinable because it is outside of the realm of normal science.

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q: **Many articles and books, by creationists and evolutionists, refer to a carcass trawled off the coast of New Zealand which, it is speculated, may have been a modern-day plesiosaur. What is the truth behind these claims?**

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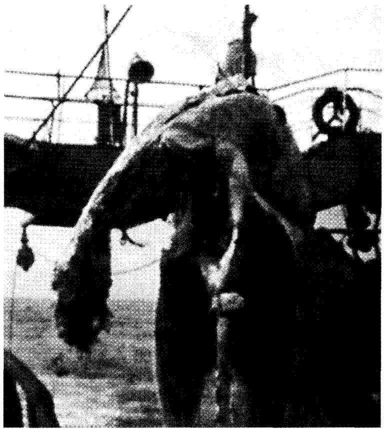
a: On 25 April 1977 a mysterious animal carcass was hauled up by a Japanese trawler, the Zuiyo-maru, from a depth of 300 metres, about 30 miles east of Christchurch, New Zealand. Photographs, measurements, and a sketch of the carcass were made by Mr. Michihiko Yano, an acting section chief of the Taiyo Fishery Company, who was on board. Tissue samples were also taken, and the carcass was subsequently disposed of overboard. Eye-witness accounts and a study of the photographs indicate that the creature had probably been dead for around 6–12 months (Seta, 1978).



Upon hearing of the discovery, the Taiyo Fishery Company contacted Dr. Fujio Yasuda, professor of ichthyology at the Tokyo University of Fisheries, for his help in identifying the creature. To aid him in this task, Dr. Yasuda decided to enlist a number of other scientists. However, before this group of experts had drawn any conclusions, the Taiyo Fishery Company called a press conference on 20 July 1977 at which they disclosed the fact that a strange carcass had been discovered. Within days, newspapers, television, and radio were speculating about the identity of the animal. In an attempt to clear the ensuing confusion, Dr. Tadayoshi Sasaki, President of the Tokyo University of Fisheries, drew together scientists from many different fields to investigate the problem and publish their conclusions. The group met twice during September 1977, and in 1978 their collected papers were published by the Société Franco-Japonaise d'Océanographie (Sasaki, 1978).

As I found it impossible to obtain a full copy of this report in the United Kingdom, I applied to Dr. Makoto Manabe, Curator of Fossil Reptiles at the National Science Museum in Tokyo. He kindly sent me a copy. Some of the salient points are summarised here.

Omura, Mochizuki, and Kamiya, (1978) point out that the carcass had pectoral and dorsal fins with fin-rays. These are characteristic of fish, contradicting the idea that the carcass was a plesiosaur, since marine reptiles and mammals have skeletal limb supports. Furthermore, if the creature was a plesiosaur, the limbs should have become detached from the backbone by this stage of decomposition. The photographs of the carcass reveal that the limbs of the creature were still attached (Hasegawa and Uyeno, 1978). But if the creature was not a plesiosaur what was it? Electron microscopy and chemical analysis of horny fibres taken by Mr. Yano from the pectoral fin of the animal support the conclusion that the carcass was that of a shark. The horny fibres were almost identical to basking shark elastodin in morphology and amino acid composition (Kimura, Fujii, Sato, Seta and Kubota, 1978). Measurements of the body proportions by Mr. Yano also support the shark identification. For instance, the ribs were 40 cm long, too short for those of any vertebrate except the cartilaginous ribs of sharks (Hasegawa and Uyeno, 1978).

A cautionary note is sounded by Obata and Tomoda (1978), who state that there is no way to tell decisively whether the carcass was that of a reptile or shark. They suggest that even if it is a shark, it may belong to a new genus. However, they admit that the chemical analyses of the horny fibres taken from the creature's fin 'strongly support' the opinion that the animal was a shark, and that 'there are no known fossil reptilian species which agree with the animal under investigation' (p.52).

Basking sharks have sometimes been called 'pseudo-plesiosaurs' because of their close resemblance to the extinct marine reptiles as a result of decomposition. Comparison of a photograph of a basking shark carcass published in the magazine *Diving World* with the New Zealand carcass shows that they are extremely similar in appearance (Anon, 1978). The New Zealand carcass was not the first to cause such confusion. Another case was that of the 'sea serpent' washed ashore at Stronsay in September 1809. According to Commander Rupert T. Gould, who examined vertebræ from the carcass in 1933, this animal was undoubtedly a basking shark (Dinsdale, 1966). Many additional examples of basking shark carcasses being mistaken for plesiosaurs or sea serpents are given in a classic book on the subject by cryptozoologist Bernard Heuvelmans (1968).

A related myth, often repeated, is that a postage stamp featuring a plesiosaur was issued in Japan in 1977 to commemorate this momentous discovery. In fact the stamp was probably issued to celebrate the 100th anniversary of the founding of the National Science Museum in Tokyo and almost certainly had nothing to do with the New Zealand carcass (Boyle, 1994).

In conclusion, it appears that the weight of evidence points to the New Zealand carcass being a decomposed basking shark, though possibly of a currently unrecognized and unusually large species. Claims that the carcass was that of a recently-living plesiosaur cannot be supported, and it is strongly recommended that creationists refrain from them.

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News of Creation

Symbiosis

WE have often pointed out the implications of *symbiosis:* the close and essential relationship between, for example, insects and plants. We believe that this demonstrates the need for the partners to have been created alongside each other and within short periods of time. The evolutionist sees their relationship as an indication of the parallel development of each in conjunction with the other. Indeed, they would argue that an insect evolved to exploit the flowers. We would argue that there is little, if any, evidence of this actually occurring.

A recent report has complicated the issue for evolutionists. Dr. Stephen Hasiotis, a palæobiologist from Denver, U.S.A. (along with Russell Dubiel and Tim Denko) has discovered a bees' nest in a petrified forest, which is claimed to be 220 million years old. The remarkable thing about this is that it was supposedly there for a hundred million years before the evolution of the flowers on which they rely for nectar!

A biological Adam

A FEW years ago we reviewed the research which claimed that we had all descended from a common female ancestor in Africa, often called the 'African Eve'. As Nancy Darrell showed, though it might appear an attractive theory to creationists, it was one to treat with some scepticism scientifically. There has been much debate on this subsequently in the scientific literature.

Now workers have claimed an 'Adam' for this Eve! Robert Dorit, Hiroshi Akashi and Walter Gilbert have studied a section of the DNA on the male Y chromosome in men from around the earth. To their surprise, in spite of the different racial backgrounds, the DNA was identical and there was no indication of random mutations, the key mechanism in evolution. Again, this is no surprise to creationists: all races are from the same stock, Noah and his wife, and that bottleneck was in the recent past compared to conventional geological claims.

The workers estimate that their results put an upper limit of 270,000 years on the appearance of an African Adam. This means that he cannot be a direct descendent of *Homo erectus* who was supposed to emerge about one million years ago. Surprise, surprise!

In reviewing a new book, *The Origin of Modern Humans and the Impact of Chronometric Dating,* the reviewer commented, 'I enjoyed the candour of the writers of these papers—they are open about their uncertainties. Where uranium-series dates are concerned, for example, they mention the cases where the results seem to conflict with the confident expectations of those who study fossils or archæological remains. Moreover the technique is rarely applicable to the actual sites where hominid remains have been found, so correlations have to be made with other sites and even other areas . . .' Then again, 'The archæologists are, on the whole, more reticent than the fossil measurers about declaring the archaic populations were completely replaced by newcomers, though that is the ultimate message. Such hedging of bets is understandable, since archæological data are so fragmentary and ambiguous that you can generally find support for a wide range of views among them.'

EDITORIAL NOTE

Because of lack of space, Part 4 of the series on The Bible and Chronology, covering the Geochronological View, has been held over to the next issue. Similarly, correspondence arising from this series will be included in a later issue.

Some news items have also been squeezed out. Our apologies, but it is good to have a surfeit of material!

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